VOL. XIV. No. 6. JUNE 1929.

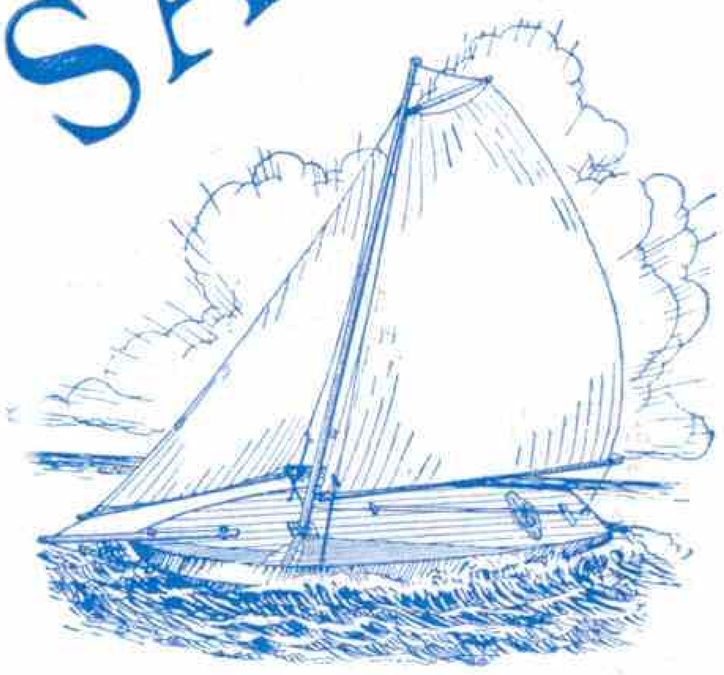
MECCANO MAGAZINE



HOSPITALS FOR CRIPPLED SHIPS (see page 434)

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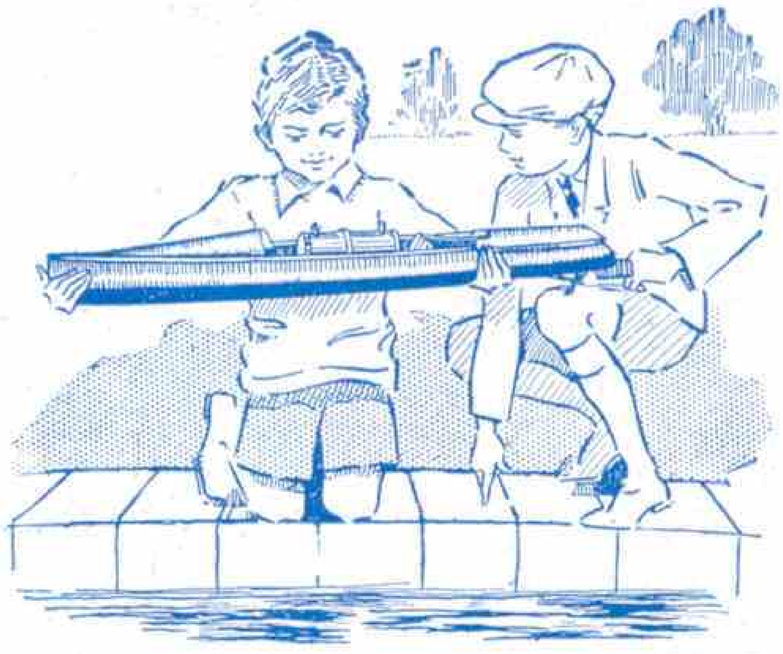


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MECCANO MAGAZINE

Editorial Office:
Binns Road
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Vol. XIV. No. 6
June, 1929

With the Editor

The Most Famous Diamond in History

The recent mysterious disappearance of a packet of diamonds during its journey from South Africa to this country is a reminder that 79 years ago an even more precious parcel left India on its way to Great Britain. Although it was so small that its weight was only a little more than a pound, it was entrusted to the care and watchfulness of two chosen officers of the British Army. These precautions were justifiable, for it contained the celebrated "*Koh-i-noor,*" or Mound of Light, the wonderful diamond that played such a fatal part in Indian history. This world famous jewel is now the private property of the Royal family, but a model of it is shown with the Crown Jewels exhibited in the Tower of London.

While in the East the "*Koh-i-noor*" had an astonishing history. It is said that for thousands of years every prince and chieftain in India and the surrounding countries had been ready to do anything in order to obtain possession of the wonderful diamond, and during that time they fought, cheated and murdered each other for it.

It was not only its brilliance and monetary value that attracted them, for Indian legend associated good fortune with its possession. This may have been true in the earlier days of the history of the "*Koh-i-noor,*" but in later times its possession was simply a source of danger, for rivals would stick at nothing in order to obtain it.

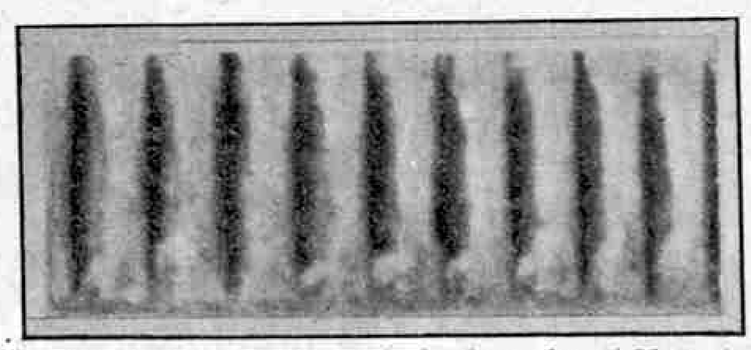
Many of the stories associated with changes of ownership of the jewel tell of war and bloodshed, but at times it was stolen in a more polite manner. For instance, in 1735, Nadir Shah led a great army across the Northern mountains and took possession of Delhi, the capital of the Mogul Emperor, then owner of the "*Koh-i-noor.*" The soldiers and ministers of the invader searched every corner of the city for loot, and kept a particularly sharp lookout for the historical diamond. Their efforts were in vain, however, for the Emperor had carefully secreted it in the folds of his favourite turban.

Eventually the hiding place was betrayed to Nadir Shah, who was so completely master of the city that he could easily have taken the diamond by force. Instead he waited until a ceremonial meeting took place, when he suggested that the Emperor and himself should follow the Eastern custom of exchanging turbans in token of goodwill! The unhappy Emperor had no option but to comply, and with the best grace he could muster, he passed over the turban within which the precious Mound of Light was hidden and its new possessor took the famous diamond to Persia.

After Nadir Shah's death the stone passed through many hands and finally was stolen by Runjit Singh, who became ruler of the Punjab. It is amusing to learn that Runjit Singh sent to the wife of the chieftain from whom he had stolen it to ask the value of the diamond! He received the remarkable answer that "If a strong man were to throw four stones, one north, one south, one east, one west and a fifth stone up into the air, and if the space between were to be filled with gold, all would not equal the value of the "*Koh-i-noor.*"

This valuation was decidedly exaggerated but it shows how highly the glittering jewel was regarded. Its fame has not been eclipsed even by the amazing "*Cullinan*" diamond discovered in 1905 in South Africa. When discovered this weighed 3,025 carats, or about 1⅓ lbs. It has been cut into two gems, each of which is many times larger than the older jewel, which weighed 186 carats before being re-cut in 1862, when its weight was reduced to 106 carats. But it is doubtful if the "*Cullinan*" diamond will ever achieve the fame of the "*Koh-i-noor,*" for it is scarcely likely that the long and romantic history that gives the latter its interest will be repeated. Fortunately the days are gone when the desire for the possession of such a splendid jewel as the "*Koh-i-noor*" could occasion a great war.

No. 7. WHAT EVER IS IT?



Here is the seventh puzzle in the series of Mystery Photographs that is creating considerable interest. You are asked to say what this curious object is and to write your answer on a postcard. Address it to "Editorial Competition No. 7, Meccano Limited, Binns Road, Old Swan, Liverpool," and post it to reach me before the 30th June.

To the first reader to send an exact answer, or to the reader who gets nearest, I will send an autographed copy of my book "Engineering for Boys."

May Mystery Photograph

When the sixth mystery photograph was laid on the Editorial table, I confess I was inclined to reject it as being far too obvious. Later study of the print, however, revealed many hidden possibilities and, sad to relate, most of my readers seem to have discovered the possibilities instead of the reality.

Out of many hundreds of competitors, very few—less than 50 in fact—dipped a pen into a circular inkpot and took a worm's-eye view from underneath! The first correct entry examined was from F. Gibbons, 28, Hartland Road, West Kilburn, London, N.W.6, to whom an autographed copy of my book "*Engineering for Boys*" has been sent.

The majority of the competitors, no doubt having recently used the family oilcan to get their cycles into condition for evening runs, voted for an oilcan. Other interesting suggestions were: a hunting horn, a smoker's pipe, motor car reflector, a pendulum, and a saucepan.

A Wonderful American Tunnel

The story of the boring of a great tunnel is always a romance of engineering, and the latest structure of this kind is no exception. This is the Holland Tunnel that passes beneath the Hudson River and thus connects the American mainland with Manhattan Island, on which New York is built. Its cost was almost £10,000,000 and it took seven years to build, in spite of the great use made of machinery. The work was marred by the deaths, through overstrain, first of Clifford M. Holland, who planned it and after whom it was named, and then of Milton H. Freeman, his assistant and successor, but it was brought to a successful conclusion by Ole Singstad, the third of the engineers who undertook the task of building the world's most remarkable under-water tunnel.

The minimum speed of vehicles in the twin tubes of this remarkable tunnel is 30 miles per hour! On account of the enormous volume of motor traffic that passes through it, elaborate precautions have been taken to ensure a continual supply of pure air, and it is interesting to learn that tests were actually made on parties of students at Yale University in order to determine the maximum amount of the poisonous constituent of exhaust fumes that could be allowed. I hope to include a complete account of this and other features of this interesting tunnel in an early issue of the "*M.M.*"

Hospitals for Crippled Ships

Marvels of the Modern Floating Dock

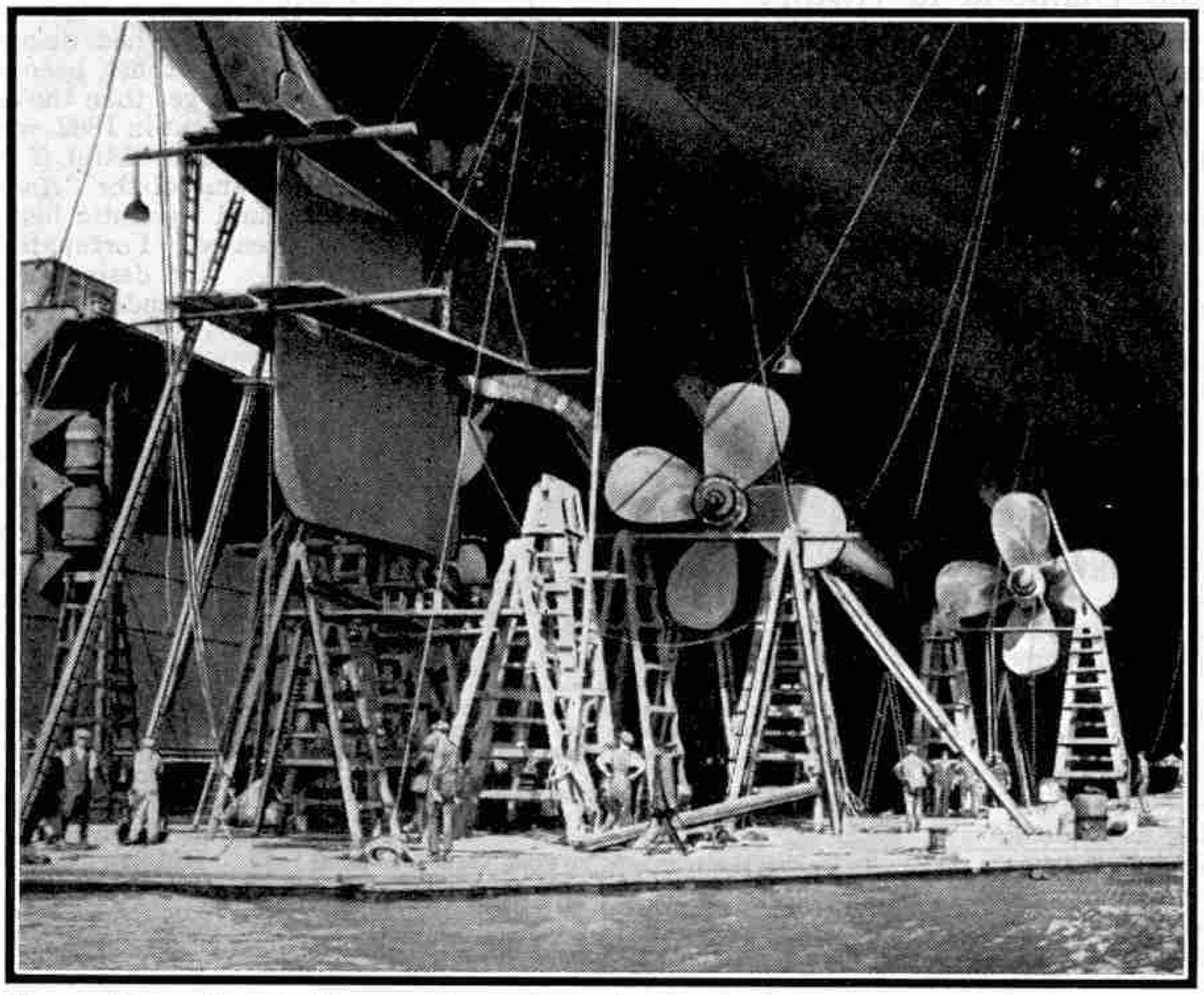
By Harold J. Shepstone, F.R.G.S.

HOWEVER accurately-designed and perfectly-built a vessel may be there inevitably comes a time when it is necessary for her to go on the "sick-list." Her ailment may amount to only the need of a fresh coating or two of paint or it may be found necessary to remove from the ship's bottom the accumulation of barnacles and marine weeds that has perceptibly reduced her speed. On the other hand a storm may have handled her roughly with the result that a plate has started far below her waterline, or perhaps she has run foul of a rock or other obstruction and received an ugly gash in some part of her steel walls.

Whatever may be the trouble the necessary overhauling can only be carried out by placing the ship in a dry dock, of which there are three distinct types—the excavated masonry-lined graving dock; the slipway and the floating dock. The first two types are fixed structures while the third, as its name suggests, floats like a ship and can be moved from place to place as occasion demands. The floating dock is by far the most interesting of the three types. It may be roughly described as a huge cradle of steel possessing a mass of delicate yet enormously powerful machinery and capable of lifting out of the water, and holding quite securely, the largest liner or the heaviest battleship.

The floating dock is not, as is often supposed, a recent invention, for a patent in respect of a structure of this type was obtained as far back as 1795 by a man named Watson. This dock was a wooden affair shaped like a barge and provided at the end with strong doors. In operation the dock was submerged to the required extent by some system of partial flooding. The vessel to be repaired was then floated in, the doors were closed and securely fastened and the water was pumped out, thus causing the dock and its burden to rise above the waterline. According to modern standards Watson's floating dock was a very crude structure and it was capable of lifting only very small vessels. Nevertheless it was quite efficient within its limitations and it served to demonstrate that the idea of a floating dock was perfectly sound and practicable.

Modern floating docks are built of steel and consist of sectional pontoons attached to two parallel sidewalls that extend the full length of the dock. They are constructed on slipways in a similar manner to ships and, in the case of floating docks of great length, are built and launched in separate sections which are afterwards pinned together. The number of sections or pontoons constituting a complete dock floor varies according to the overall length of the structure. Some floating docks have only two or three pontoons while the giants of the class may consist of six or seven sections.



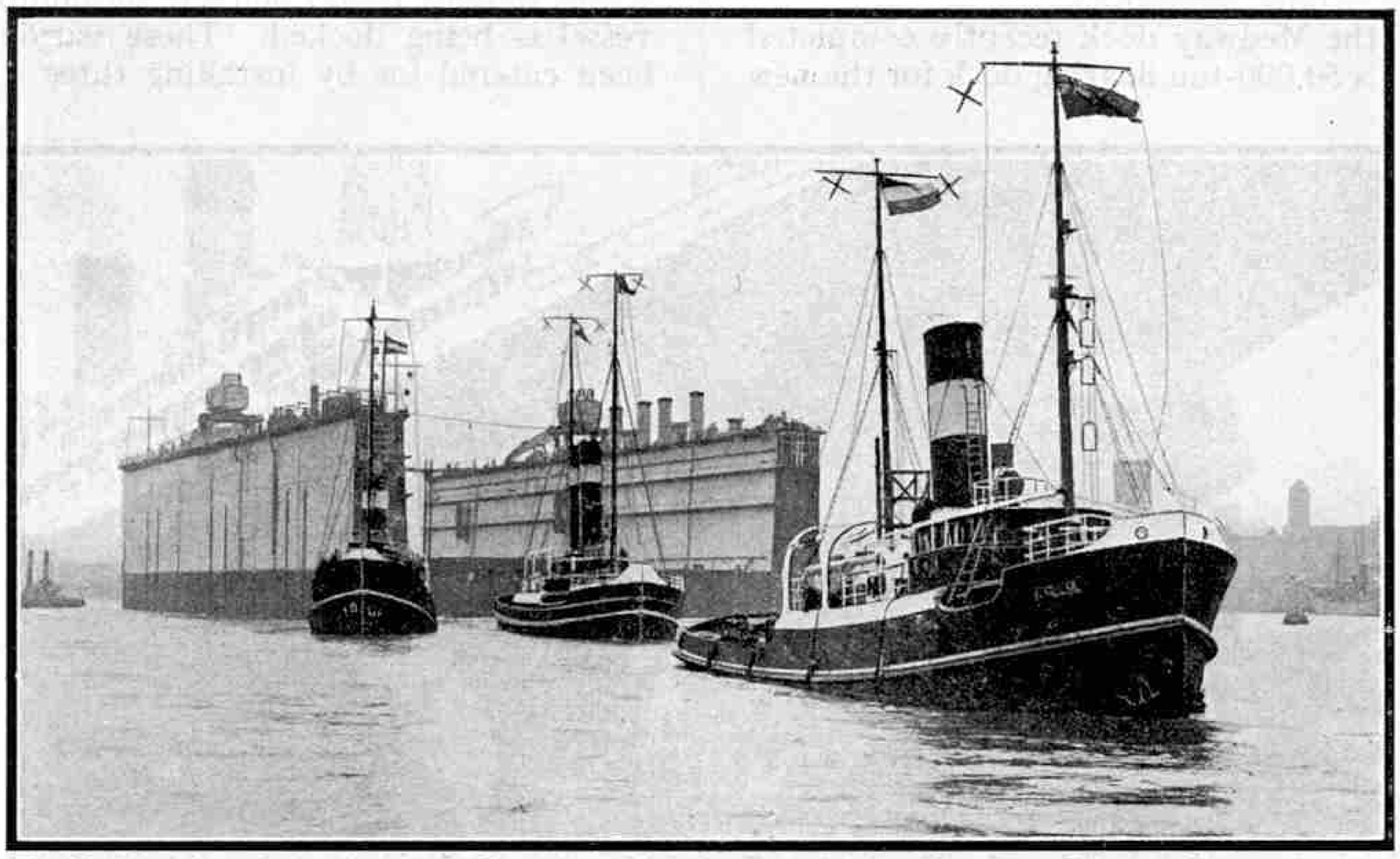
The rudder and port side propellers of the "*Majestic*" as seen from the deck of the Southampton floating dock

A floating dock is open at both ends and as viewed from either end it is a U-shaped structure. The absence of end doors enables it to accommodate vessels of greater length than itself and in this respect it possesses a big advantage over the graving dock, the closed ends of which limit the length of vessel that can be berthed. Even if a floating dock is unable to lift an unusually long vessel entirely out of the water it usually is capable of raising it sufficiently for the necessary repairs to be carried out. On one occasion, for instance, the Barrow floating dock, which is 204 ft. in length, partially lifted the liner "*Empress of China*," which is nearly double its length; while recently a 3,000 ton dock lifted the stern of a 4,500-ton vessel high enough out of the water to enable a new propeller to be fitted.

The pumping machinery of a modern floating dock is installed in one of the huge walls, and the crew's quarters are provided in the other wall. A light railway track carrying one or more travelling cranes, each capable of handling a load of several tons is laid along the broad top of each wall. The admission of water into the pontoons and into certain compartments of the lower portion of the walls causes the dock to sink.

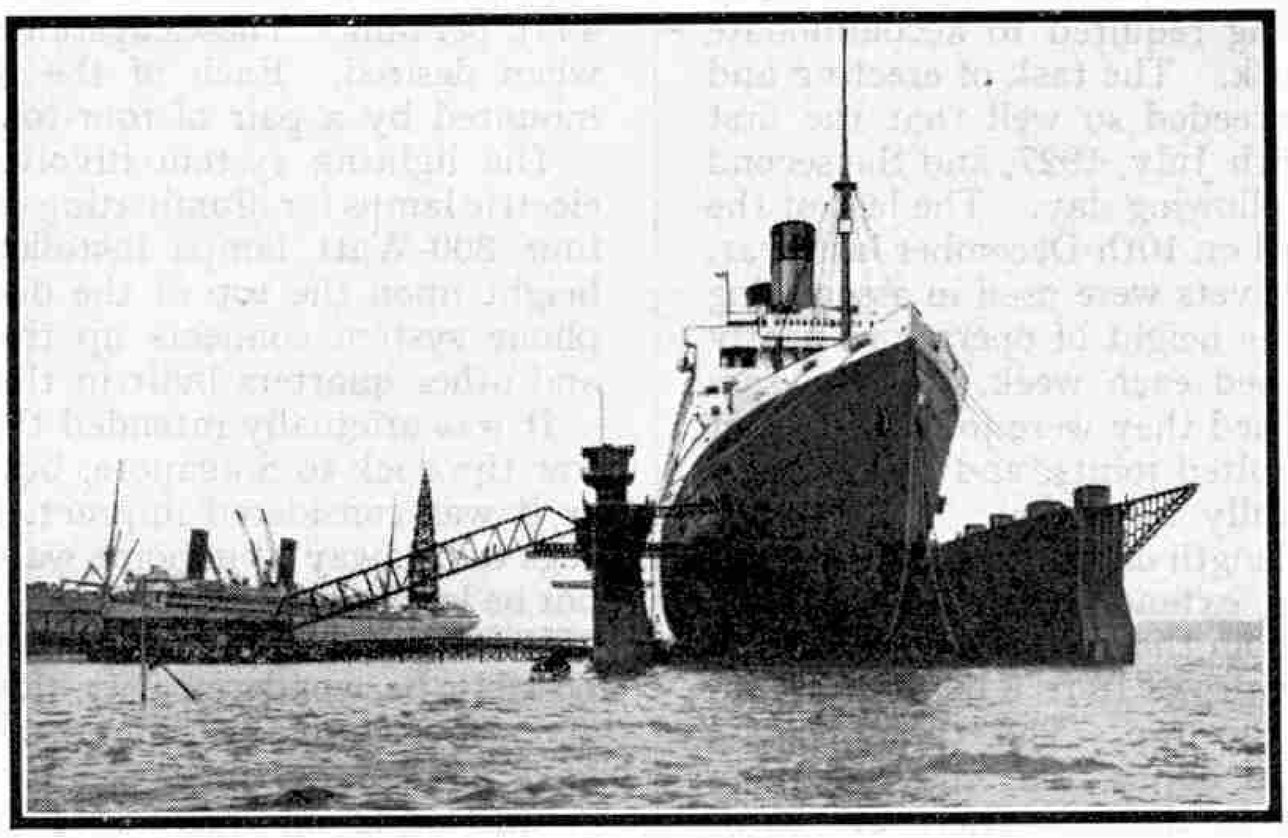
The subsequent discharge of this water not only restores the buoyancy of the dock but also enables it to lift a load having a weight equal to the difference between the weight of the dock itself and its displacement.

When a floating dock has been flooded sufficiently to cause it to sink low enough for the ship to be floated over the pontoons, the ship is towed in between the partially submerged walls by means of steel hawsers manipulated from capstans on the wall tops. As soon as the vessel has been brought to a standstill in the desired position and is correctly poised over the hidden line of keel blocks, the pumping machinery is started up and the draining of the dock is begun. Massive, mechanically-operated steel arms known as "side shores" are projected from the inner side of the wall until they press against the ship and thus serve to hold it steadily in position.



The first section of the Singapore floating dock being towed down the River Tyne at the commencement of its long voyage

As the pontoons and wall compartments are pumped clear of water the dock gradually rises and presently the line of blocks centred along the tops of the pontoons touch the keel of the ship and the actual lifting then begins. At last the dock floats upon the surface of the sea or river and the vessel is seen high and dry in her steel cradle. This elevation of the under-water section of the ship's hull is a great boon to the workmen who carry out the overhauling operations, for instead of having to work in the dim light and damp cold air that exist in the depths of a graving dock they are able to carry on their job from the spacious and well-lighted floor of the floating dock—a great change for the better.



A giant liner awaiting release from a floating dry dock

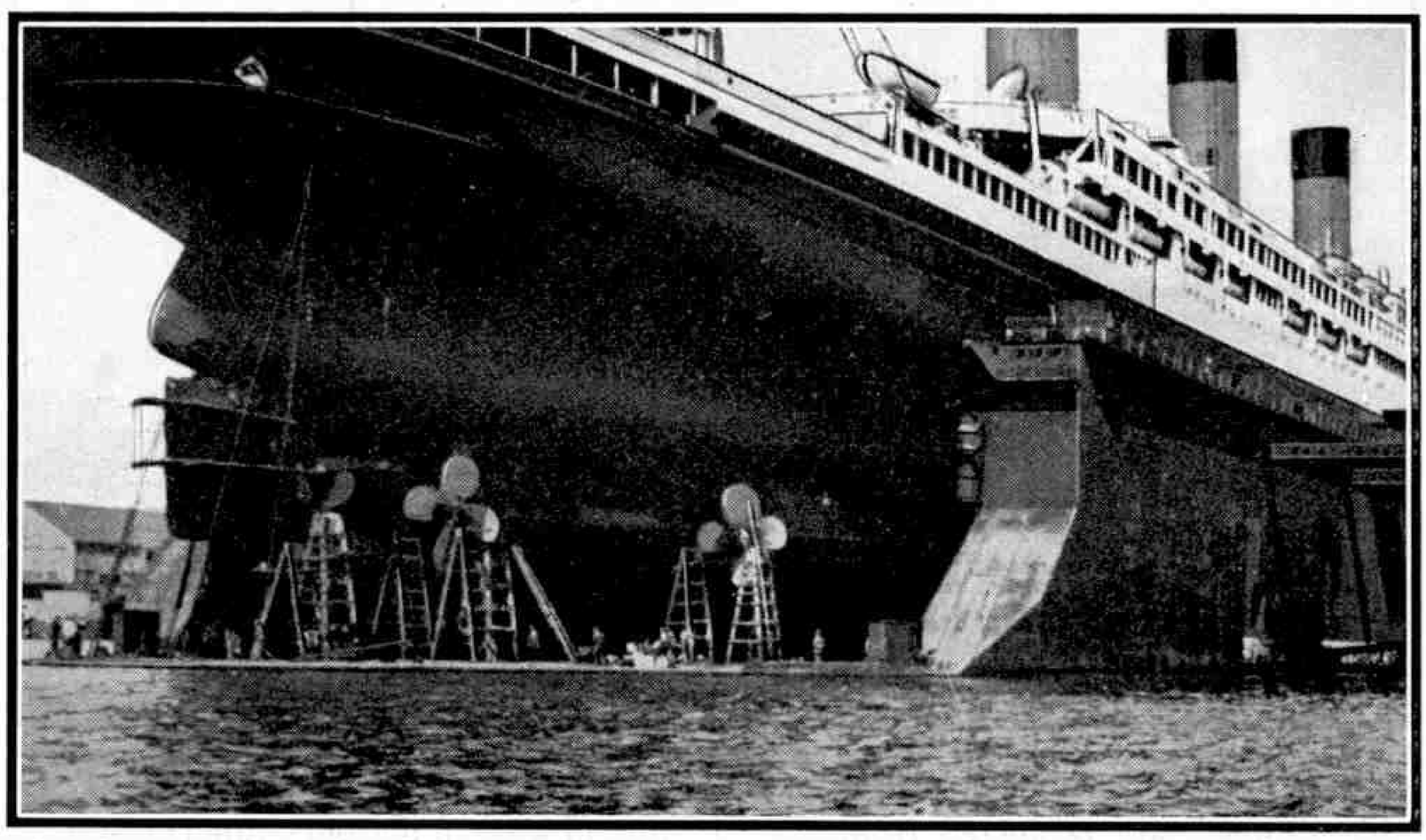
There are two types of floating docks—the "box" type and the "self-docking" pattern. The pontoons of a box type dock are fastened together permanently, with the result that whenever it becomes necessary to clean or repair the under-water portions the dock has to be placed in a graving dock. The permanent binding of the pontoons imparts the maximum of rigidity to the dock, however, and in this respect it is the stronger of the two types. In the self-docking pattern any individual pontoon can be "unpinned" and floated inside the remainder of the dock, where it can be dealt with as required just as though it were a vessel.

The comparatively recent rise in popularity of floating docks is due to the rapidity with which they can be built, their mobility, and their small construction cost compared with that of a graving dock. Whereas a floating dock capable of lifting a modern liner or battleship costs from £300,000 to £400,000, a graving dock to accommodate the same size of vessel would cost more than double the sum. In addition, the former can be built in a few months, while the construction of a large masonry-lined graving dock requires three or four years to complete. Unlike the fixed structure, the floating dock has the whole world before it. If trade deserts the port where it is operating, it can be transferred, whereas the graving dock must remain idle.

Several floating docks of huge dimensions and great power have been constructed in this country for duty at home or for service in distant parts of the Empire. A floating dock of 33,000 tons capacity was built by Swan, Hunter & Wigham Richardson Ltd., of Wallsend-on-Tyne, to the order of the British Admiralty, and is now stationed in the Medway. This dock has raised large battle cruisers in 2½ hours. It is of the "box" type with an overall length of 680 ft., the two massive side walls each being 15 ft. in thickness and more than 60 ft. in height. It has an entrance width of 113 ft. and is 144 ft. in width at the middle. Three large pontoons make up the floor, and they are sub-divided into 60 compartments. A system of pipes and valves enables water to be passed into any of these divisions at will, the valve of each compartment being controlled by the dock master from a central position known as the valve house.

The dock is electrically lighted throughout and is equipped with several powerful arc lamps for use when docking or repairing a vessel at night. There are also special arrangements to facilitate the use of electric hand lamps during night repair operations. More than 12,000 tons of steel was used in constructing this dock, and an additional 2,000 tons was absorbed in providing her numerous and important accessories.

The builders of the Medway dock recently completed at their Tyne yard a 50,000-ton floating dock for the new British naval base at Singapore. It is one of the largest of its class and was designed by Sir W. G. Berry, Director of Naval Construction at the Admiralty. The dock has been built and equipped in the remarkably short period of approximately 14 months. Delivery of the 20,000 tons of steel required was commenced in January 1927, and was completed by the following July without the slightest hitch occurring.



Another stern view of the "*Majestic*" held high and dry in the floating dock. The diminutive figures of the workmen in the dock emphasize the great height of this famous liner

The seven sections of the dock were built and launched separately, and the construction of the first three sections was carried out with the utmost possible speed owing to the slipway concerned being required to accommodate the later sections of the dock. The task of erecting and riveting the steelwork proceeded so well that the first section was launched on 15th July, 1927, and the second pontoon launched on the following day. The last of the seven sections was launched on 10th December last year. Approximately $3\frac{1}{2}$ million rivets were used in assembling the pontoons and during the height of operations nearly 140,000 rivets were absorbed each week. As the successive sections were launched they were joined together by means of riveted and bolted joints, and by the close of last year the dock was fully assembled.

The dock has an overall length of 850 ft. and a width of 172 ft. while the side walls, extending the length of the dock, are 50 ft. in height from the pontoon deck. Each of the walls tapers from a width of 18 ft. 6 in. at pontoon-deck level to 16 ft. at the top. The three central pontoons are each 25 ft. in depth, and the remaining pontoons each 17 ft. 6 in. in depth. There are three lines of keel blocks laid along the pontoon deck. The dock is of the "self-docking" type.

The main pumping equipment includes three 43 in. pumps capable of delivering approximately 100 tons per minute; two 27 in. pumps having a delivery of about $66\frac{1}{2}$ tons per min., and two 20 in. pumps capable of dealing with approximately 33 tons per min. The valves governing the flow of water into or out of the pontoons and wall tanks, when sinking or raising the dock, are worked by compressed air. All the pumps are electrically operated. They are situated in the bottom of the dock and are connected with the motors in the motor room by means of vertical shafting. The motors have been specially designed to withstand the tropical conditions under which they will be required to operate.

The electrical power required varies from a few k.w. for lighting and maintenance purposes, when the dock is idle, to more than 1,500 h.p. for pumping alone, when a vessel is being docked. These varying demands have been catered for by installing three 1,000 k.v.a. three-phase, steam driven turbo-generators, any two of which can adequately feed the main pumps; one 250 k.w. 220-volt d.c. Diesel generator for use during working hours when the dock is not in general use, and one 36 k.w. 220-volt d.c. Diesel generator for service after working hours. Steam is supplied to the main generators from four "Yarrow" type oil-fired boilers, each of which is capable of evaporating 20,000 lb. of water per hour.

The dock is provided with eight electrically-driven capstans each capable of exerting a pull of 16 tons at 45 ft. per min. These capstans can be operated manually when desired. Each of the walls of the dock is surmounted by a pair of four-ton travelling wharf cranes.

The lighting system involves the use of about 700 electric lamps for illuminating the dock itself, and twenty-four 300-Watt lamps installed in standards 10 ft. in height upon the top of the dock walls. A 35-line telephone system connects up the various machine rooms and other quarters built in the walls of the dock.

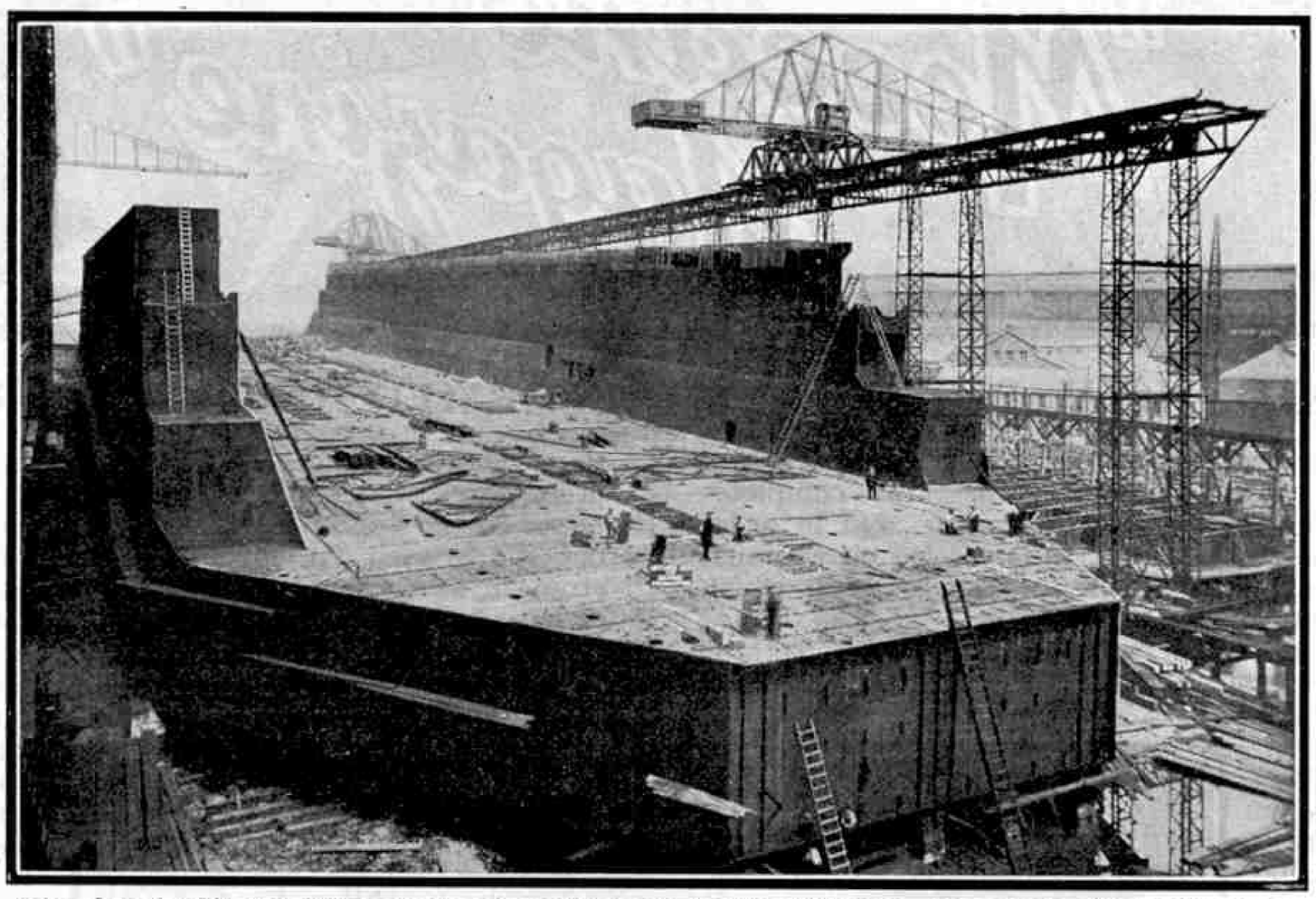
It was originally intended that Admiralty tugs should tow the dock to Singapore, but the plan was abandoned as it was considered impracticable for the Government tugs to be away from home waters for a period that could not be less than three months. Accordingly the task was entrusted to a Rotterdam tug company. It might possibly be wondered why this work should have been given to a Dutch firm, but as a matter of fact the Dutch have made a great speciality of heavy long-distance ocean-towing, and have developed a remarkably efficient type of vessel for this particular work.

The dock started from the Tyne on its long journey of 8,600 miles in two portions, one consisting of the centre section and the other of the two ends joined together for the trip. Each portion was in the care of four tugs, two of which towed the dock while two others guided it from the rear. The tow ropes were 1 ft. 9 in. in diameter.

Drawing only 7 ft. of water and towering 75 ft. above the sea, the two portions of the dock proceeded slowly on their voyage. For several days rough weather

made it impossible to pass through the Straits of Gibraltar but eventually this entrance to the Mediterranean was negotiated and the journey continued to Port Said.

The most interesting and in many respects the most difficult part of the long voyage was the passage through the Suez Canal. This was an extremely delicate towing operation on account of the very small clearance between the tug and the canal walls, which in some places was only about 3 ft. The work of the tugs was further complicated by the large area of the dock walls fully exposed to the wind. The journey through the canal took four days and during that period the waterway was closed to other through traffic.



The Admiralty Floating Dock, now stationed in the Medway, in course of construction. The photograph conveys a good impression of the great depth of the pontoons and the immense thickness of the walls of the dock

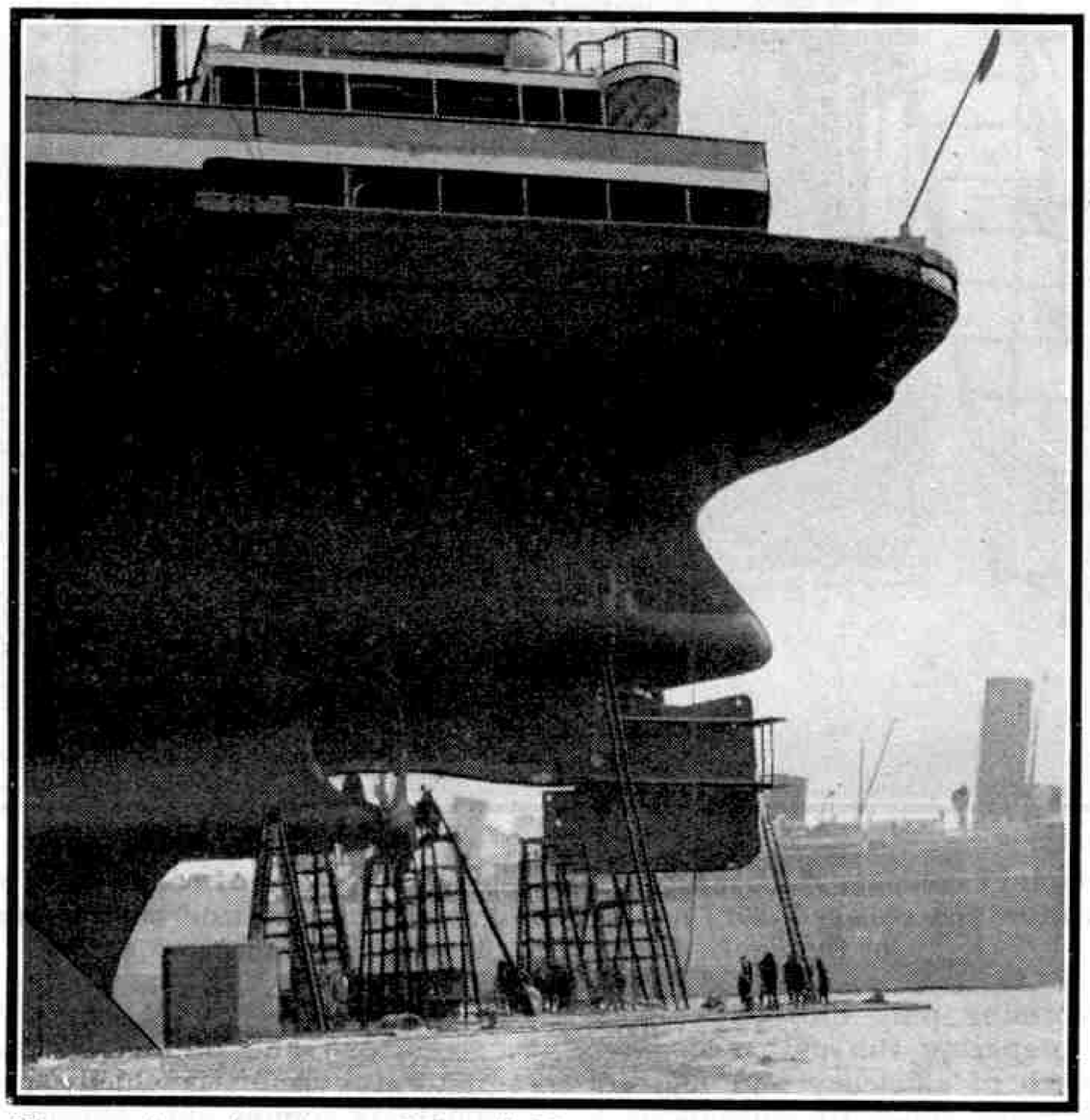
The passage was negotiated without the slightest hitch and resulted in the sending by the British Admiralty of congratulatory telegrams to the Canal Authorities, and to Swan, Hunter and Wigham Richardson Ltd., the builders of the dock.

The first portion of the dock arrived safely at Singapore on 13th October last, 18 days ahead of its scheduled time; the second portion completed its long trip three days later.

Even in the calmest of weather the towing of a large floating dock is by no means an easy matter and when rough weather is encountered the seamanship and vigilance of those in charge of operations is taxed to the utmost in order to avoid disaster. On one occasion a floating dock was conveyed from the Tyne to Callao in Peru, a distance of approximately 11,000 miles. The dock left this country in August, in charge of two ocean-going tugs, but it did not arrive at Callao until April of the following year. In the Atlantic the strange procession encountered very heavy seas, and for days progress was almost negligible. Off South America some of the hawsers snapped, and in one violent storm both dock and tugs were damaged so seriously that they had to put into a port for repairs. Two months elapsed before they were ready to resume their journey.

The remainder of the voyage included the negotiation of the Strait of Magellan, and many experienced seamen declared that any attempt to tow the dock through the strait would end in disaster. Both tugs and dock won through, though not without bearing signs of the struggle, and eventually arrived at Callao.

The largest floating dock in the world is stationed at Southampton. It was built in 1924 by Sir W. G. Armstrong Whitworth and Company, and has a lifting capacity of 60,000 tons. This huge structure has an overall length of 960 ft. and an inside width of 130 ft. The greatest feat carried out by this dock was the lifting of the world's largest liner, the "*Majestic*" of the White Star Line. During the winter months the North Atlantic Shipping Companies lay up their ships in succession for overhauling, re-painting and re-decoration, and with this object in view the "*Majestic*" was dry docked at Southampton on 26th March, 1925. The lifting of this stupendous mass was carried out without the slightest hitch and the unique sight of the world's largest liner resting in the world's largest floating dock aroused extraordinary public interest. The lifting operations were duly carried out and on April 9th the giant vessel was undocked. The sinking of the dock commenced at 7.30 a.m. and by 10 a.m. the ship was afloat. In due course tugs took charge of her and by 11.30 a.m. the "*Majestic*" had been safely towed to her berth.



The overhanging stern of the "*Majestic*" cradled in Southampton floating dock

In 1918 Germany built a floating dock over 400 ft. in length and 130 ft. in width, designed specially for testing submarines. A huge steel cylinder 40 ft. in diameter and weighing some 2,000 tons extended the full length of the dock and occupied the position ordinarily assigned to the middle line of keel blocks. The dock could be

(*Continued on page 505*



XII.—HOW PULP IS TRANSFORMED INTO PAPER

LAST month we described how wood, rags, and esparto are broken up and converted into pulp. This completes the first step in the manufacture of paper, and in order to see how the second part of the process is carried on we must follow the course of the pulp through the saw mills in which the transformation is completed.

The mills in which paper is now made differ greatly from those of a century ago. They are much larger, and are full of enormous and complicated machines that convert the beaten pulp into paper at smaller cost and with less labour than in the days when paper could only be made by hand.

The most interesting of the many wonderful machines to be seen in a modern mill is that on which the paper actually is made. Its invention is due to Nicolas Louis Robert, a printer's reader in Paris, who in 1798 constructed a crude machine that made paper in pieces from 10 to 12 yards in length. The invention was introduced into Great Britain by the brothers Fourdrinier, two prosperous London stationers who spent a fortune of £60,000 on improving it. Unfortunately they were unable to recover any of the money spent in this manner, for the Government refused to extend for their benefit the period for which the original patent was granted. In the end the brothers died almost without means, one of them living for some time on a small allowance from a fund raised on his behalf by "*The Times*."

Modern paper-making machines work on the same principle as that of Robert, but they have been improved almost out of recognition, and are capable of transforming pulp into paper with astonishing speed. Machines for preparing the pulp also have been developed to a wonderful pitch of efficiency and most of the operations now carried on in paper mills are automatic.

On arrival at the mills the pulp is broken up and beaten to ensure that the fibres are thoroughly separated and reduced to the required length. This is done in a machine called a "beater," the bleached pulp being mixed with water and forced under revolving knives that the paper-maker describes as "tackle." These may be sharp or blunt, their condition depending on the kind of paper that is being made. For instance, in making blotting paper the fibres must be quickly separated and cut into short lengths, and therefore sharp knives are used. On the other hand, if the pulp is intended for the production of strong paper of the type used for wrappings, the fibres must be teased out and bruised without cutting them, for such papers owe their strength to the length of the fibres that are interlaced with each other. In making paper of this kind the "tackle" is kept blunt.

The fibres of the pulp from which writing paper and good printing paper are made must be separated and reduced in length, but they must not be cut into the short tubes characteristic of blotting paper. The paper on which the "*M.M.*" is printed is of this kind, and in making it the pulp is beaten with tackle that is between blunt and sharp in condition.

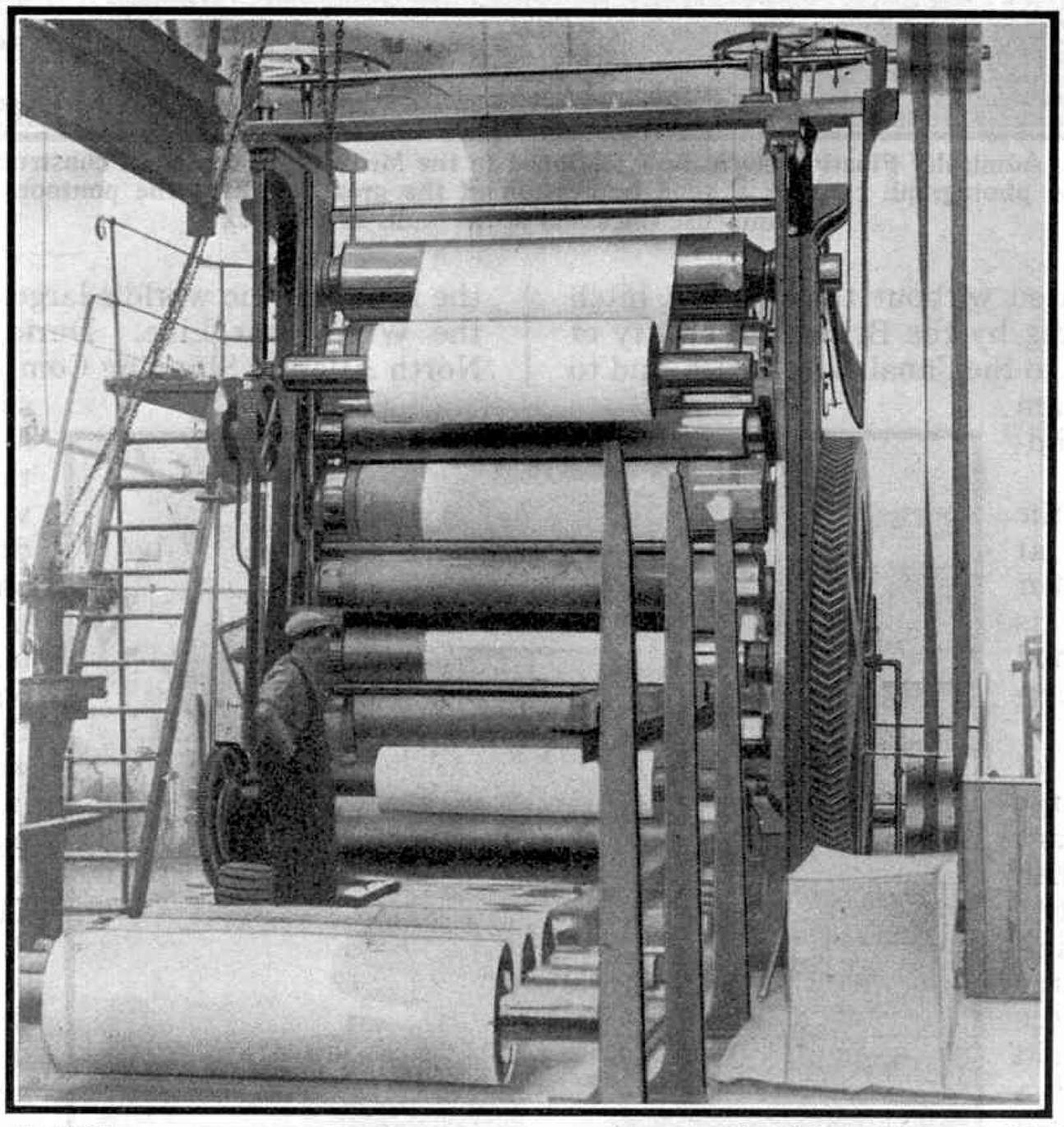
Occasionally knives are dispensed with altogether and the beating is carried out by stone rollers. This is done when a tenacious pulp suitable for making strong grease-proof paper is required.

Several other interesting operations are carried out while the pulp is in the beater. One of these is loading. Paper consisting only of fibres would be of very little value for either writing or printing purposes, for its surface would lack smoothness and it would absorb ink too readily. Something must be added therefore to fill up the space that is left between the fibres.

The chief loading material used is china clay, or kaolin, which comes chiefly from Cornwall. For use it is ground to a fine powder and mixed with water. The liquid is strained in order to remove gritty or sandy particles before it is added to the pulp in the beating engine. Another material often used is gypsum, a natural form of calcium sulphate, which gives a good tone and an even surface to paper containing it. The natural gypsum is chiefly used, but precipitated calcium sulphate is coming into favour, for it is lighter and bulkier, and is more easily retained in the pulp.

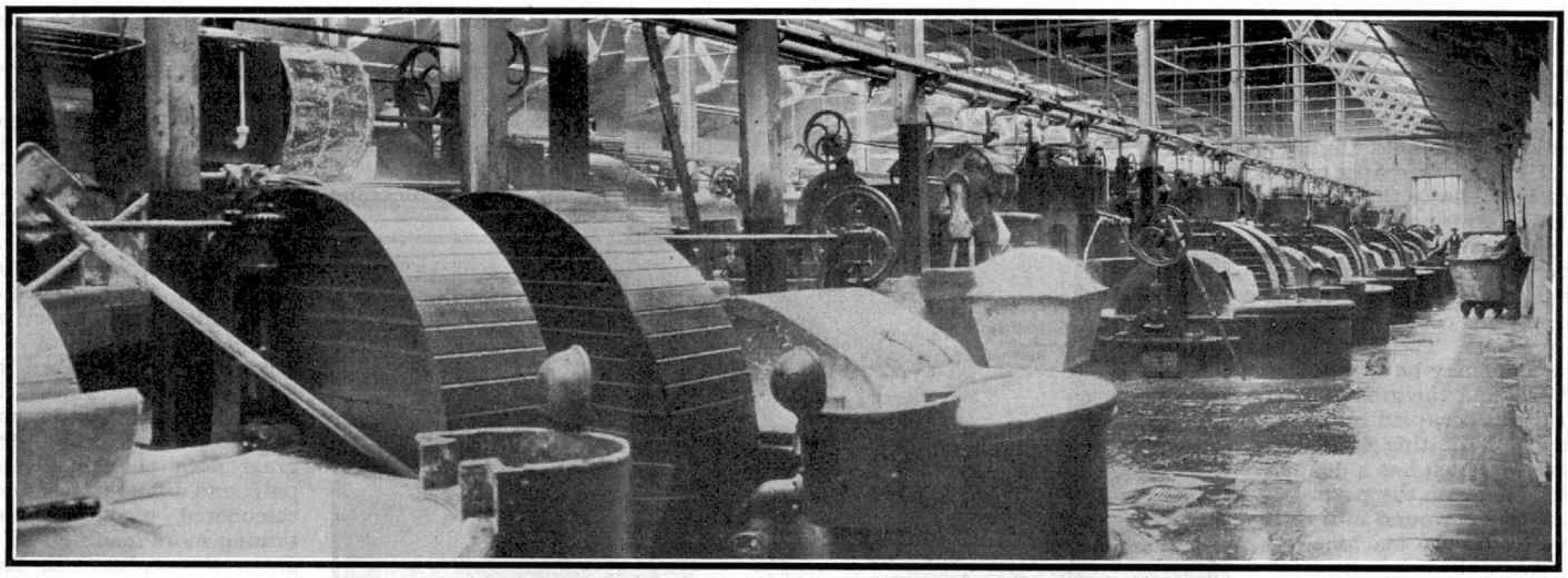
It is in the beating machine that the final colour of the paper also is settled. The pulp has already been cleaned and bleached, but if nothing further were done the paper made from it would be dull white in colour. Blue powder is therefore added, as this has the effect of giving the paper a better tone.

The paper used for printing the "*M.M.*" is white, but coloured paper is required for many purposes, and any shade desired may



Courtesy] [*Guard Bridge Paper Co. Ltd.*

A stack of calender rolls. Alternate cylinders are made of compressed paper or cotton and polished iron, and the latter are heated to iron out the surface of the paper as it passes through the machine



The beater room of a modern paper mill. In the tanks shown above, the pulp is beaten in water until its fibres are thoroughly separated. The quality of the paper depends very greatly on the efficiency with which the beating operation is carried out

be produced by the addition of dyes varying in colour from blue to scarlet or black. These include both natural and artificial dyestuffs, the colours derived from coal tar being greatly favoured, for they are cheap and easy to handle, while in brilliance and fastness they surpass most natural dyestuffs.

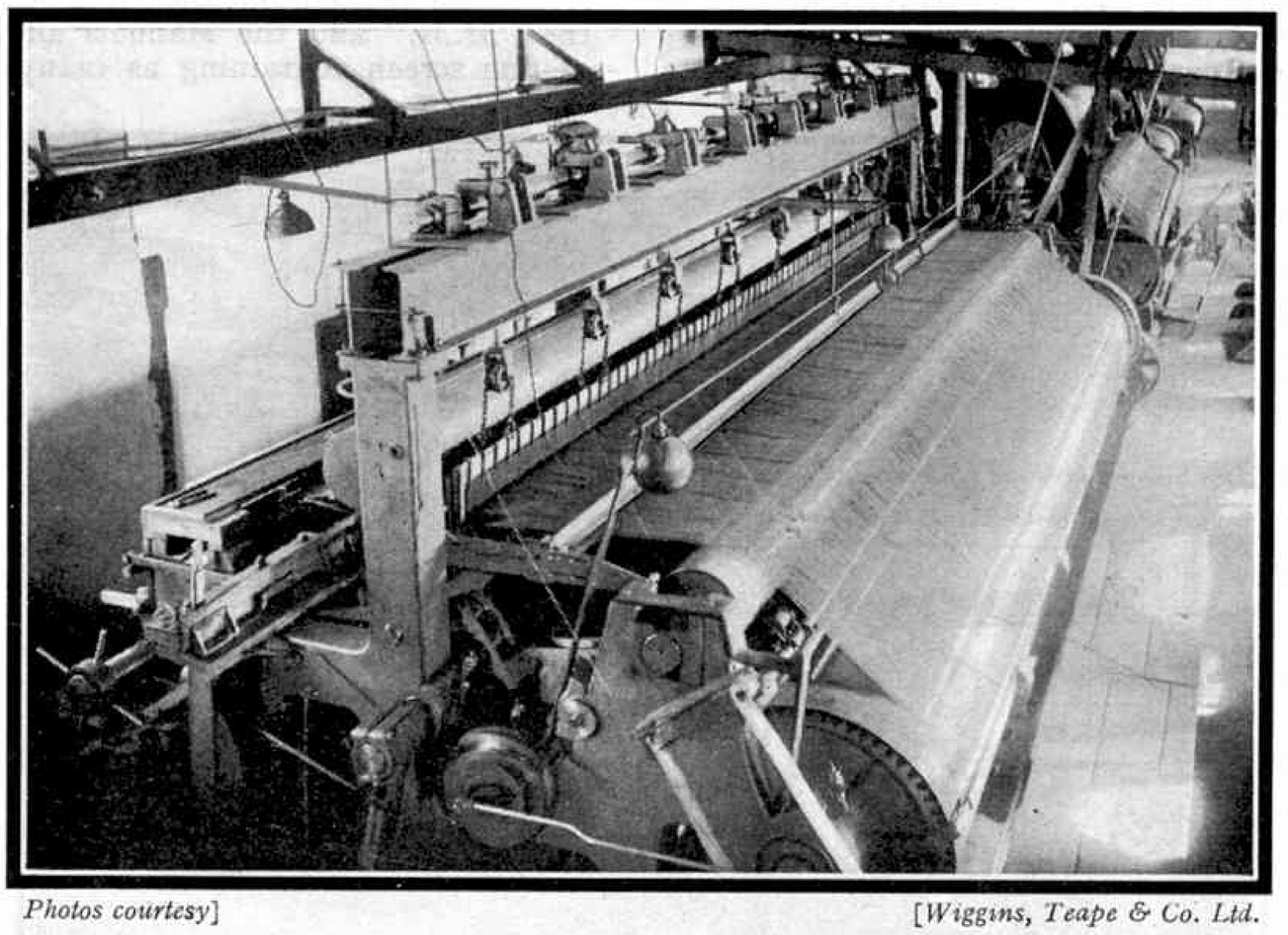
Even this does not complete the work carried on in the beater. So far we have seen how the bleached pulp is broken up, loaded, and coloured. Paper made from it after this treatment would be limp and spongy, and still quite useless for either writing or printing purposes, for ink would spread both outward and downward on it. It would, in fact, be merely blotting paper, or "waterleaf," as it is called in mills. In order to transform it into writing paper it must be sized, or treated with resin or gelatine. The effect of this may be tested easily by comparing the surface of a piece of blotting paper with that of a sheet of writing paper. The former is soft and its pores are open; the writing paper is harder and smoother to the touch because its pores have been stopped up by the addition of size, which also increases the cohesion between the fibres and thus makes the paper less liable to tear.

Except in making high-class writing papers, sizing usually is carried out in the beating machine. Resin is used, and this is added in the form of a soap made by boiling it with soda ash. When the soap has been thoroughly absorbed, aluminium sulphate is added, as the presence of this chemical helps to fix the resin in the fibres.

When the sizing has been completed the work of the beater is finished, but before the pulp is allowed to flow on to the wonderful machine that transforms it into paper it passes through vessels in which it is diluted and strained. These are called stuff-chests, and are capable of holding half a ton of pulp. They are usually circular, thus having no corners in which the fibres may lodge; and they contain vertical or horizontal paddles that slowly rotate to ensure thorough mixture of the fibres with water.

If the pulp is not sufficiently dilute, more water must now be added, and this is usually done in a separate vessel in which is a float connected with a water tap. If the pulp is too thick the float rises, thus allowing water to enter, and when the mixture has been sufficiently diluted the fall of the float shuts off the water supply. After dilution the pulp flows in a stream through strainers and filters that extract any particles of sand or other foreign bodies, and also remove knotted fibres.

The pulp now has a milky appearance and contains from 97 to 99 per cent. of water. In order to turn it into paper the water must be removed in such a manner that the fibres left behind are "felted" together. We have seen that in making paper by hand this felting is done in a shallow mould, the bottom of which is made of wire cloth, the superfluous water running away through the mesh and leaving on it a thin web of interlaced fibres. In the remarkable machines in use to-day the hand-maker's mould is replaced by an endless belt of wire cloth that travels round two large rollers. On one end of it runs the pulp, which spreads over the surface of the wire and is prevented from overflowing at the sides by endless indiarubber belts called "deckle straps." As the liquid is carried along it loses water and is transformed into a web of paper, but unlike that produced in a hand-maker's mould, this web is quite continuous.



Photos courtesy] [*Wiggins, Teape & Co. Ltd.*

One of the wonderful looms on which wire is woven into the cloth on which paper is made

In the production of hand-made paper the workman gives his mould a shake sideways in order to make sure that the fibres are matted. A similar movement is necessary in the case of the travelling wire cloth of a modern paper machine. If they were undisturbed, the fibres in the thin pulp would arrange themselves lengthwise in the direction of flow of the liquid, but this tendency is checked by shaking the cloth from side to side. The necessity for this is greatest when the pulp first flows on to the machine, for then the fibres are beginning to settle down as the water drains away. At this point, therefore, a specially vigorous movement is given.

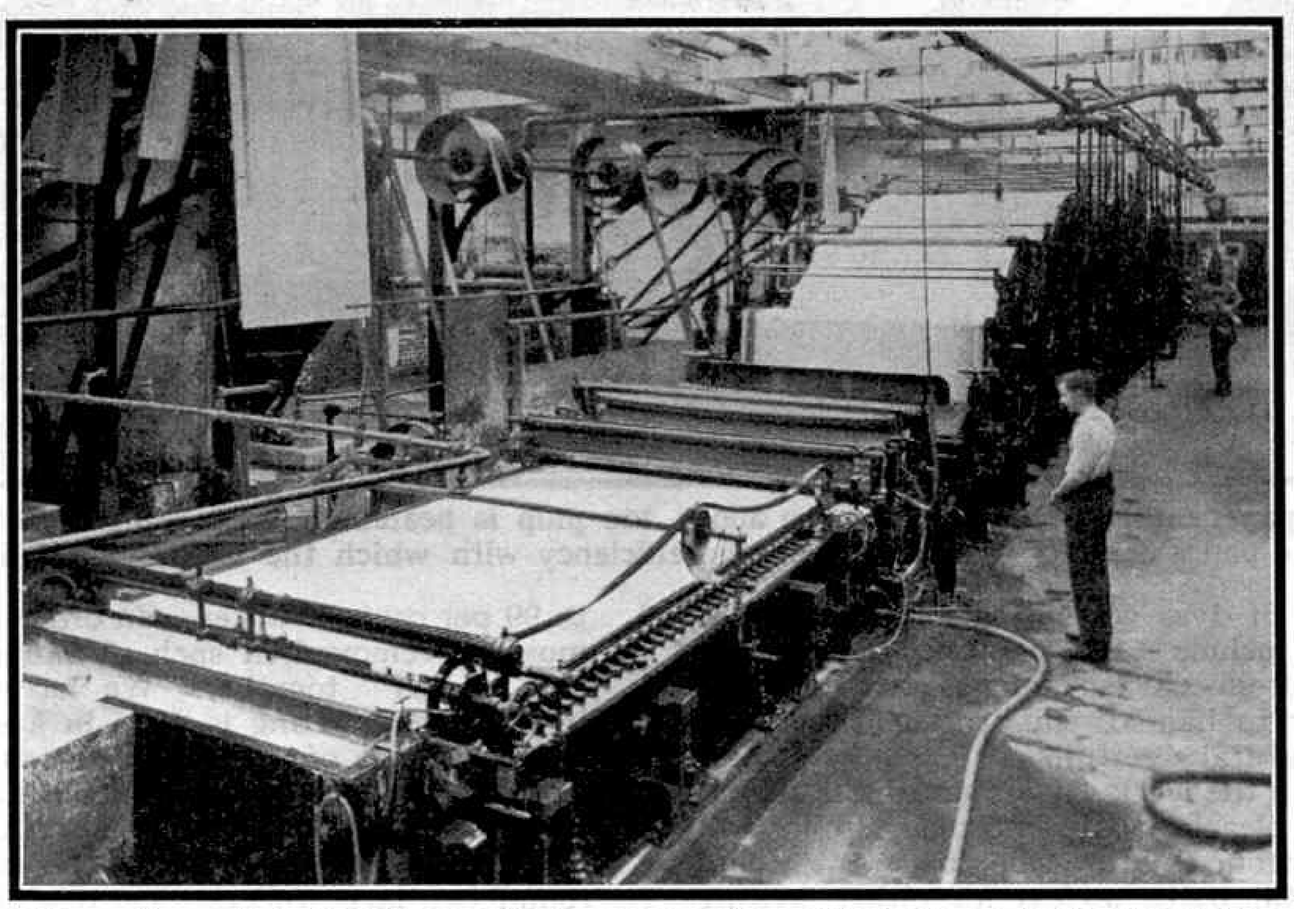
The travelling wire cloth is supported on a number of small intermediate rollers that keep it in position, and it is very fascinating to watch the operations that are carried on during its movement. On to one end of it flows a thin milky liquid which, under the eyes of the onlookers, is transformed into a thin sheet of "waterleaf" that contains only a small percentage of water. The great machine continues its work night and day, a continuous web of material that resembles blotting paper running off the cloth as the latter passes round the roll to return to its starting point. The operations are carried on automatically, the paper being untouched by hand until it has been wound into huge rolls and is ready for removal.

A very interesting operation that is carried on while the pulp is being transformed into paper is the impression of the watermark. The pattern of this is marked by a raised wire device that pushes away some of the fibres from certain portions of the paper, thus making it slightly thinner. The raised wire that forms the pattern

is stitched or soldered on a cylinder called the "dandy roll," which revolves above the travelling wire cloth and presses on the wet paper with sufficient weight to mark it. The web then passes over boxes in which a vacuum is maintained in order to suck out water, and between two cylindrical rollers that extract the bulk of the liquid that remains in it.

Although the paper may now be regarded as "made," it has only worked its way through a small section of the huge machine. The first impression of a visit to a paper mill usually is that the paper-making machine is a giant mangle, for it seems to contain nothing but rollers. The length of a machine may be as much as 200 ft. and the greater part of this is occupied by a long series of rotating cylinders, each of which has a definite work to do on the paper before this is wound into reels and leaves the machine.

The web of moist paper first encounters the wet presses, each of which consists of a pair of cylinders that squeeze out more moisture. Through these it travels in company with an endless blanket of felt, for it is still so soft that it is easily torn, and thus requires support. Next it passes over hollow drying cylinders, which are steam heated on the inside. The number of these cylinders varies considerably. On machines used for producing the kind of paper required for newspapers there may be as many as 36, but it is seldom that more than 20 are used in the manufacture of writing or printing paper, for this is drier than newsprint when it leaves the travelling wire.



Where the pulp is transformed into paper. The pulp flows on to the travelling wire cloth from the troughs in the foreground, and the web of paper is carried forward to the rollers on which it is dried and finished

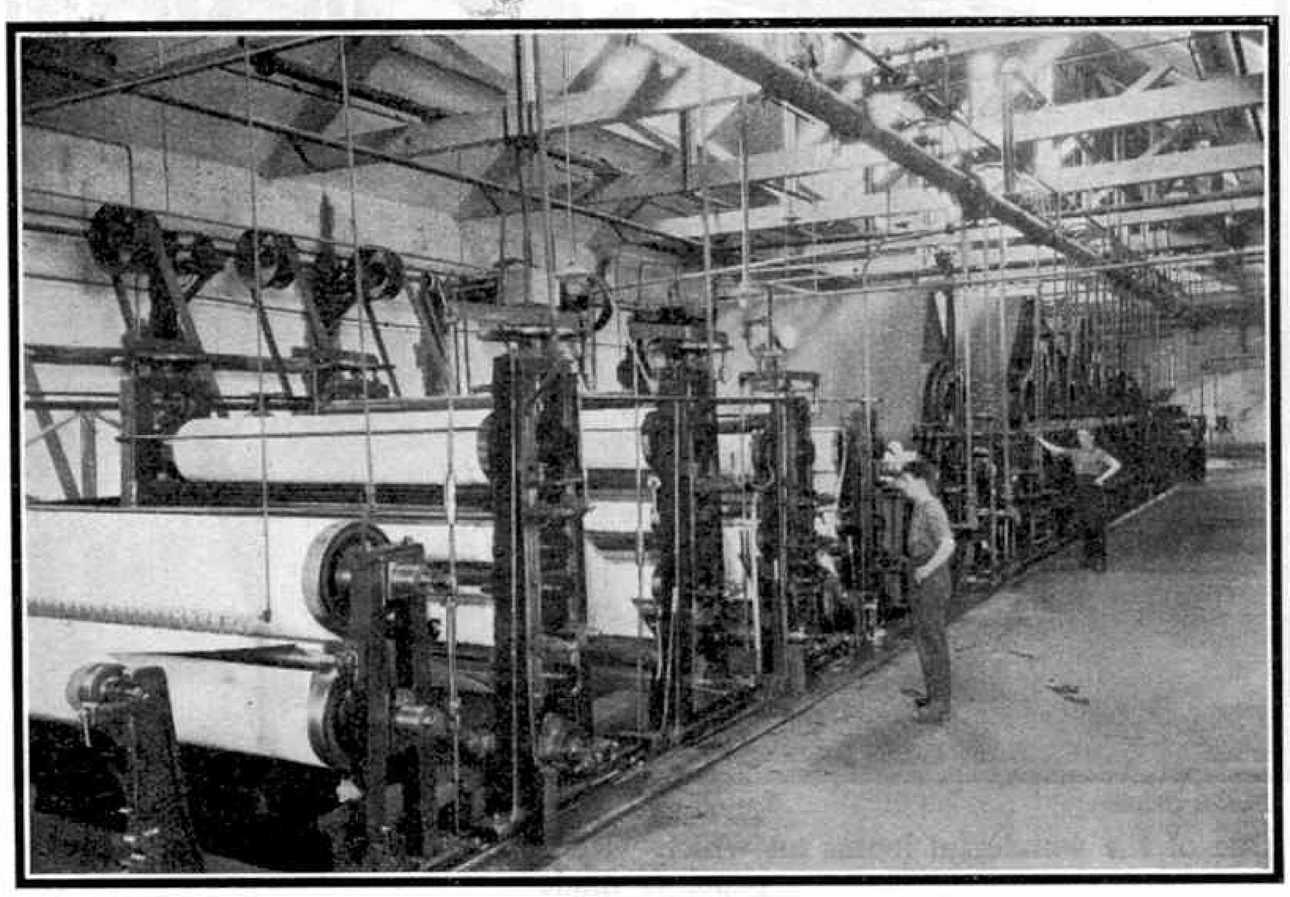
All that remains after the paper has been dried is to give it the required "finish," which simply means giving it a surface that is suitable for the purpose for which it is intended. This is done by passing it between heavy rollers called "calender" rollers, several pairs of which are fixed at the end of the machine. The pressure on the paper as it is passed between these rollers gives it a smooth and polished surface. It is interesting to find that the friction between the calender rollers on the dry paper produces electrification, which is often discharged with an accompaniment of sparks and crackles.

The paper that is used for printing the *"M.M."* is described as "double-calendered" paper, and after leaving the machine it undergoes special finishing operations in order to give it the smooth surface necessary for the reproduction of half-tone illustrations of fine screen. This finish is imparted to the paper by passing it through the rollers of a machine called the "super-calender," in which alternate rollers are made of polished iron and compressed paper or cotton. The iron rollers are heated, and thus the surface of the paper is ironed out to give a specially smooth and durable surface in exactly the same manner as linen collars are ironed in laundries.

While in the mill the paper is handled in enormous rolls, and in some cases it is sent out in this condition. This is done with the paper used for newspaper work. The wonderful rotary machines used in printing newspapers perform all the operations necessary, including cutting and folding, and are fed with enormous rolls of paper that often are as much as five miles in length. On the other hand a large proportion of paper is reduced in the mills to sheets of a convenient size for the printer, by means of cutters containing revolving knives. In addition, heavy knives that descend like the blade of a guillotine are used for cutting paper into pieces of special shape.

There are many grades of paper, and each is carefully adapted to the special purpose for which it is to be used. In this connection the paper used for printing Meccano Manuals is of special interest. We have seen that the *"M.M."* is printed on super-calendered paper manufactured from chemical wood pulp. The Manual paper, on the other hand, is of the kind usually described as "imitation art" paper. It is made from esparto grass, or from a mixture of the grass with chemical wood pulp, and differs from super-calendered paper in containing more loading. It is given a very smooth and durable surface by passing it in the usual manner through stacks of calender rolls.

Both super-calendered and imitation art paper have very fine, smooth surfaces that take excellent impressions from the printer's type. It is specially necessary to use paper of this type if good reproduction of illustrations in half-tone are to be secured. It has been explained in previous articles in this series that such illustrations are built up of dots, and the best are those prepared by means of screens of very fine mesh in which the dots are smallest. For printing on low-grade paper only blocks of coarse screen can be used, but the excellent surfaces of the papers used for the *"M.M."* and the Manuals allow the employment of blocks of fine screen containing as many as 133 lines per inch.



Photos courtesy] [*Guard Bridge Paper Co. Ltd.*

The finishing end of the paper machine shown in the upper photograph on this page. The cylinders in the foreground are the calender rolls that impart a smooth surface to the paper

The excellence of the printing work that may be done on these papers may be seen on almost any page of the *"M.M."* Unlike those composing newspaper illustrations, the dots in the pictures in the *"M.M."* are so small that they are scarcely visible to the naked eye, and they give faithful reproductions of the original photographs.

For the best class of printing work, especially if illustrations of the highest quality are required, art paper is used. Certain copies of the *"M.M."* intended for special purposes are printed on this paper, which is sometimes described as "coated" paper because it is prepared by applying a coating of enamel to its surface by means of brushes. This enamel is composed of china clay and glue, the former material giving the paper its special surface, the glue being added in order to act as a binding medium. It will be remembered that china clay is used for loading paper while in the beater, but in making art paper a larger quantity of it is used, and it is applied directly to the surface instead of being distributed throughout the paper. The coating is allowed to dry and the paper is finished off by passing it through the usual calenders.

The special value of coated paper lies in its smooth, flat surface, on which every dot is rendered perfectly. This is an especially important point when illustrations in colour are being printed, and it is for this reason that the cover of the *"M.M."* is made of art paper.

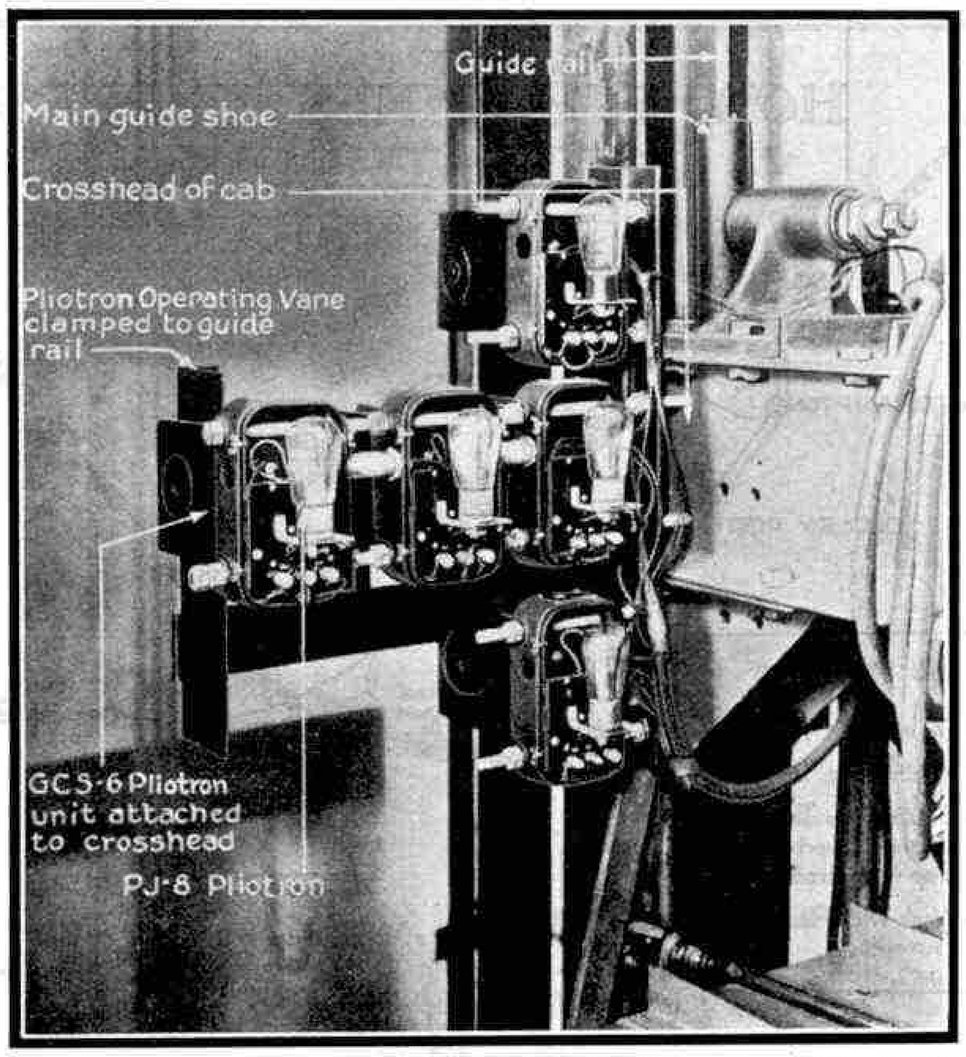
Elevators Controlled by Vacuum Tubes

Interesting Automatic Mechanism to Assist the Attendant

A NEW system of elevator control by means of which the cars are automatically brought to and stopped at the correct floor level is announced by the General Electric Company of America. This system, which is described as being unusually simple in operation and involving few extra parts, makes use of a three-element vacuum tube, similar to those used in radio sets.

This vacuum tube is known as a "pliotron," and has been used for a number of years on railway locomotives for the purpose of transmitting block signals into the driver's cab in verbal form, so that the driver does not have to depend upon watching semaphore signals by the side of the track. While the tube is similar to the ordinary radio type, it differs in the value of operating voltages that are used.

The use of the "pliotron" in the automatic control of elevator cars is based upon the characteristic increase of plate current when the tube changes from an oscillating to a non-oscillating condition. The necessary tubes are mounted on each elevator car and these tubes are normally in oscillation. By an arrangement of coils and vanes, the motion of the car as it approaches the floor level is made to stop the oscillation of the tubes, thus actuating relays. The relays govern control circuits that slow-up the car and stop it at the correct position. The method operates equally well in controlling the car in whichever direction it is running.



Courtesy [*International General Electric Co.*

The pliotron installation on the top of the elevator car, for use in pre-registering elevator control

When the system is in operation, the elevator attendant moves his car switch to the "off" position as he approaches the floor at which it is desired to stop. On nearing the floor, the relays are actuated by the combination of coils and vanes, and thus the car is slowed-up and brought to a stop at the floor level without any attention or action on the part of the attendant. When the passengers have been discharged or received, the car is started again in the usual manner and the operation continues as before.

Another application of the "pliotron" tube makes it unnecessary for the elevator car attendant to watch his position in the shaft. Devices similar to those used in automatic levelling are employed, with the addition of a signalling equipment consisting of a number of push buttons, lights, and a bell.

As each passenger enters the car, he calls out the number of the floor at which he wishes to get off, and the operator immediately presses the push button corresponding to this floor. When all the passengers are in the car, the attendant starts by the usual method. As the car approaches the first floor at which a stop is to be made, a signal light flashes and a bell rings, thereby notifying the attendant when a stop is to be made. He then moves the car switch to the "off" position and the car continues at full speed to a predetermined point in the shaft, where it is slowed-up automatically and brought level with the next floor by the automatic levelling device. Operation is continued in a similar manner until the trip is completed.

In addition to the flashing arrangements, push buttons are installed on each floor. A passenger who is waiting for a car presses a button that lights a signal and rings a bell in the first car approaching in the direction in which he desires to travel. A corridor lantern also lights up to show the passenger which car will be the first to reach his floor travelling in the desired direction. When an attendant receives a signal from a floor push button, he moves his car switch to the "off" position and the car stops automatically at the proper floor in the manner already described.

This system does away with the necessity for the elevator attendant to know his position in the shafts. So long as he pushes the button for each floor called, and shuts off his car switch each time the light flashes or the bell rings, the car will automatically make every stop that may be required.

Thus the attendant does not have to rely on his memory. He is relieved of the task of recalling where each passenger wishes to alight, and also of the troublesome duty of bringing the car to rest at the exact level of each floor where a stop is made.

Elaborate control of elevators may not seem necessary in this country, where buildings of more than ten storeys in height are rare, and most lifts ascend only a few floors. But in the United States conditions are quite different. In New York, for instance, there are many buildings exceeding 30 storeys in height, and others of equal or even greater height are being erected in Boston, Chicago and other large American cities.

In consequence of this tendency more use is made of elevators in America than in Great Britain, and the need for an automatic assistant is much greater. A system such as that described in this article obviously must be a great relief to the men who handle the passenger lifts that carry passengers to the higher floors of the skyscrapers.

FAMOUS TRAINS: XXIX.

The "*Pines Express*," L.M.S. Rly.

By Cecil J. Allen, M.Inst.T., etc.

PERHAPS the most singular thing about such a title as the "*Pines Express*" of the London, Midland and Scottish Railway is that the pines are not "L.M.S. pines" at all! It may seem equally strange to see "*The Devonian*" running over L.M.S. metals when that company owns not a yard of track in Devonshire. Through running of L.M.S. rolling stock over the systems of other railways solves the puzzle, however. The Great Western Railway sees to it that "*The Devonian*" is safely deposited in due course on the South Devon coast, and the Somerset and Dorset Joint Railway similarly takes charge of the "*Pines Express*" at Bath and brings it at last within sight and smell of the pine-woods of Bournemouth, the final stage of the journey being over the metals of the Southern.

If you look at a railway map of England you will see that the ramified L.M.S. system extends one great tentacle southward and westward from Birmingham, into the heart of Great Western territory, as far as Bristol, where the two companies jointly occupy the Temple Meads Station, to which we travelled in one of the two-hour expresses from London last month. This is the route followed by "*The Devonian*" from Bradford and Leeds to Torquay. Branching southward from this main line at Mangotsfield, near Bristol, a short spur runs into Bath, where one station is again used by two companies—the one-time Midland and now L.M.S., and the Somerset and Dorset Joint Railway. The Somerset and Dorset Railway, when in a bad financial position, was taken over jointly by the Midland and London and South Western Railways, away back in 1875, the principal object being to give the Midland direct access to Bournemouth. Now, of course, it is jointly owned by the L.M.S. and Southern Railway but, like the Midland and Great Northern Joint, it is the proud possessor of its own locomotives and rolling stock. So it is to the care of a royal blue Somerset and Dorset locomotive that the Midland red L.M.S. engine hands over the "*Pines Express*" on arrival at Bath.

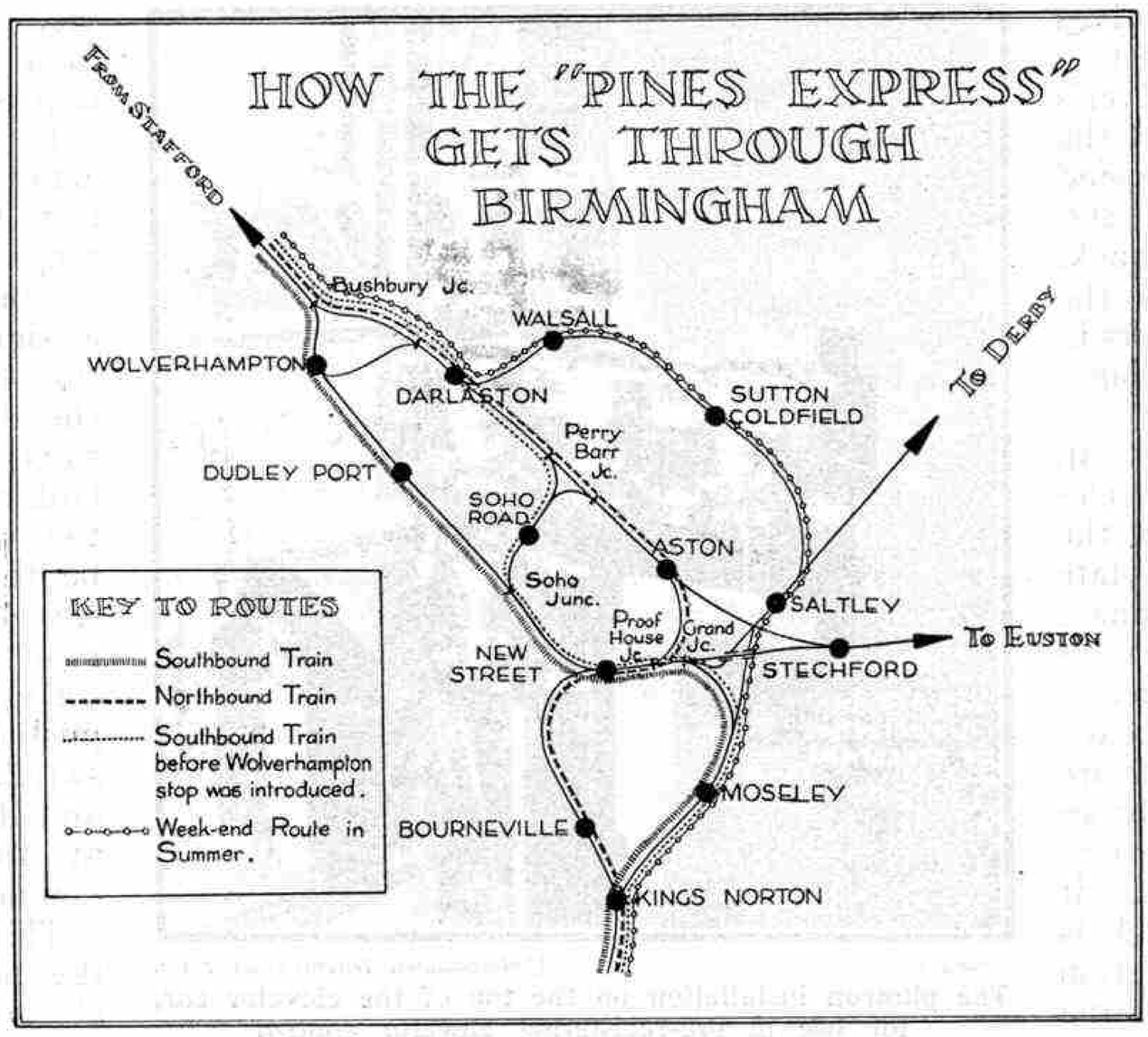
In the course of its long journey from Liverpool and Manchester to Bournemouth, the "*Pines Express*" does some curious things. It was first instituted by the London and North Western and Midland Railways in conjunction, the former bringing it down as far as Birmingham, where it was handed over to the latter. In exactly the same manner it is now handed over from the Western to the Midland Division, and is in this way the only regular passenger train that crosses from one set of tracks to the other outside the great New Street Station. Apart from this, it is the only daily express that is worked by the Western Division from Birmingham away to the North out of the opposite end of New Street, as though it were off to London. This has the remarkable result that, whether you are travelling to Bournemouth or from Bournemouth, in either case you run out of the east end of New Street, and yet without any reversal of the train!

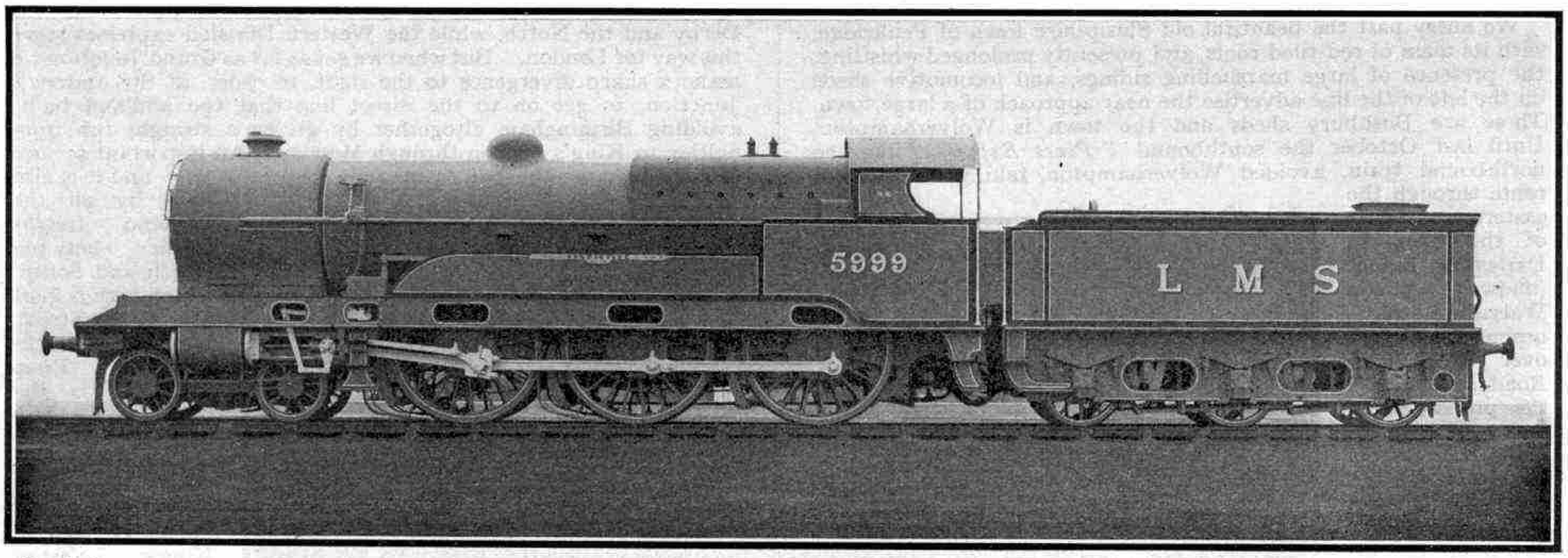
Again, as it leaves Wolverhampton out in the cold when going north, it is the only daily express to run over the short length of line connecting the Portobello and Bushbury Junctions just outside that town. At summer week-ends the "*Pines Express*" gives the great city of Birmingham the "go-by" too, running round a much more extraordinary route through Walsall and Sutton Coldfield on to the main line from Derby, and then by the connecting spur up to King's Norton, where the West of England main line of the Western Division is joined. Over this route it is the only express train ever seen.

A word or two now as to the composition of the train. The main section of it, including the ubiquitous restaurant cars, works through between Manchester (London Road) and Bournemouth. In pre-grouping days this was Midland stock, and the restaurant cars only ran between Birmingham and Bournemouth; the Midland Division still finds the coaches and the cars, but the latter complete the whole journey in each direction. So far as through working is concerned, Liverpool has to be content with one through "composite" for Bournemouth, but this is strengthened by a four-coach corridor set for Birmingham, as the "*Pines Express*" provides the fastest service of the day from both Liverpool and Manchester to the great Midland city and back, and is correspondingly popular.

There is one more coach in the Liverpool section, and that is destined for Southampton. The "*Pines Express*" carries it as far as Cheltenham, where it is detached in order to work over the one-time Midland and South Western Junction Railway through Swindon to Andover, and thence over the Southern to Southampton. In the grouping the M. & S.W.J.R., which was previously an independent company, became the property of the Great Western Railway, and the G.W.R. therefore advertises itself in the formation of the "*Pines Express*" by providing its own Liverpool-Southampton coach, the gay cream and umber livery striking a brilliant note on the tail of the long procession of Midland red vehicles. When the whole train is assembled, between Crewe and Birmingham, it is therefore very heavy, seldom consisting of less than 14 corridor vehicles, though the proportion of the total journey over which this loading prevails is fortunately short.

It is at 9.40 a.m. that the Liverpool portion of the "*Pines Express*" is due to leave Lime Street, just ahead of the 9.45 a.m. "*Merseyside Express*" from Liverpool to London. It is, of course, much pleasanter to be going to the seaside than to be coming away from it, so that naturally we patronise the southbound train; though, truth to tell, we are but a few miles away from the Irish sea when thus we make our start for the English Channel. Up the tremendously deep rock cutting, varied by a remarkable succession of short tunnels, we mount at 1 in 93 over the route of the original Liverpool and Manchester Railway—whose centenary is to be celebrated next year—until we reach Edge Hill. A brief stop, and we are away again at 9.46 a.m., threading our way through the maze of junctions between here and Wavertree, which need to be seen on a plan in order that their complexity may be properly appreciated. We also pass the great Edge Hill concentration sidings, which were among the very first in the country to be laid out for marshalling by gravity.





Courtesy] [*L.M.S.*

No. 5999 "*Vindictive*," one of the re-boilered "Claughtons" fitted with the original Walschaerts Gear

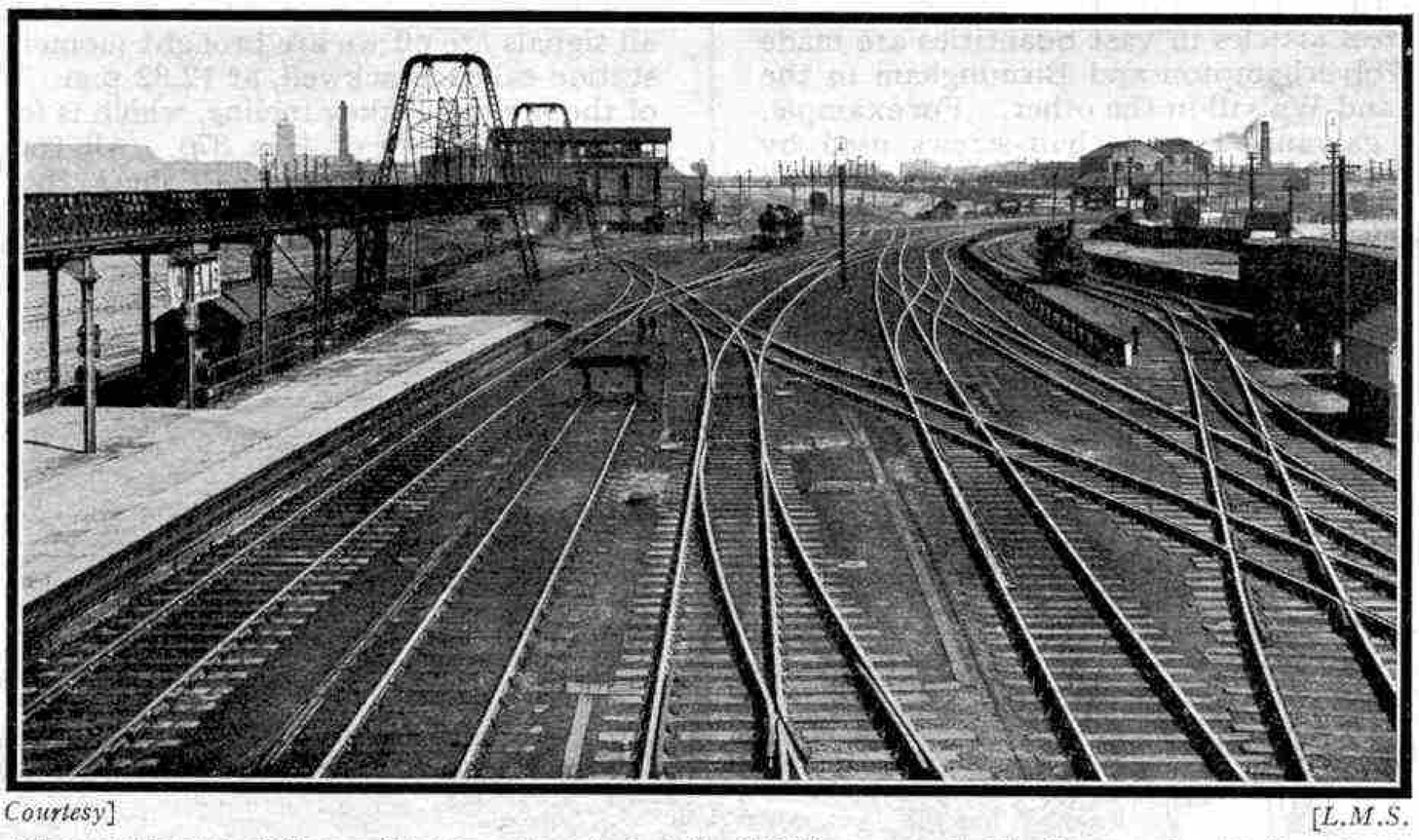
In the ordinary course we do not travel far before the next stop, as the train is booked to call at the Liverpool suburban station of Mossley Hill, if required, to pick up any passengers for Birmingham and beyond. Very few of the expresses so booked to make a "conditional" stop at Mossley Hill ever fail to do so; even the proud "*Merseyside Express*" almost always makes its first halt, on the non-stop journey from Euston to Liverpool, at this station, so bringing to an end the longest all-the-year-round non-stop run on the L.M.S. system, 189¾ miles in length.

The next stop after leaving Mossley Hill at 9.52 a.m. is at Crewe, where we are to meet and be attached to the Manchester portion of the train. There are four tracks as far as Ditton Junction, and we gather speed on the falling grades from Speke to Ditton, taking water at full speed from the track-troughs close to Halebank Station. At Ditton Junction, on the left of the line, we see the large creosoting works at which the major portion of the sleepers used in relaying on the Northern part of the L.M.S. Western Division are creosoted, and then "chaired," preparatory to laying. Enormous stacks of sleepers in course of seasoning are the chief means of attracting the attention of the passer-by to the depot.

We have now to cross the biggest engineering work that we shall see on the whole route. When the Manchester Ship Canal was cut through from the estuary of the Mersey to "Cottonopolis," to give ocean-going steamers direct access to that city, the five main lines of railway crossing its route could not have their traffic interrupted by swing-bridges, which would enable the steamers to get by. The Ship Canal Company therefore had to raise each line to a height sufficient to clear the steamers passing underneath, involving very high embankments and the big bridges that may be seen at Irlam and Partington on the Cheshire Lines system (we crossed the latter in February with the L.N.E.R. "*North Country Continental*"); then the L.M.S. bridges at Latchford and Acton Grange (the second carrying the West Coast main line) near Warrington, and now here between Ditton and Runcorn.

Of these five bridges Runcorn is the biggest. We bear to the right after Ditton Junction, mounting a high embankment on to a brick viaduct as we circle round the great chemical works established here, and last of all passing on to the bridge itself. This consists of three lattice girder spans, each 305 ft. across, carrying the track 75 ft. above the water level. The Ship Canal is crossed just before we get to the opposite side. The view from the bridge is very extensive. On the left the Runcorn transporter bridge and the smoky chimneys of Widnes monopolise most of the foreground, but on the right any clear day will enable you to see the mountains of Wales in the far distance.

There is further climbing from Runcorn until we reach the summit at Sutton Weaver, whence we fall until we bear to the right to effect a "flying junction" with the main line from the North, at Weaver Junction. A high viaduct carries us over the River Weaver; next we hurry through the salt country, round Winsford; and presently we are running past the east side of the great Crewe locomotive works. Here we note the remarkable suspension bridge, with its enormous span over the tracks at the north end of Crewe station, which gives access to the works from the platforms, ere we come to rest at 10.34 a.m. We have run the 32 miles from Mossley Hill in 42 minutes.



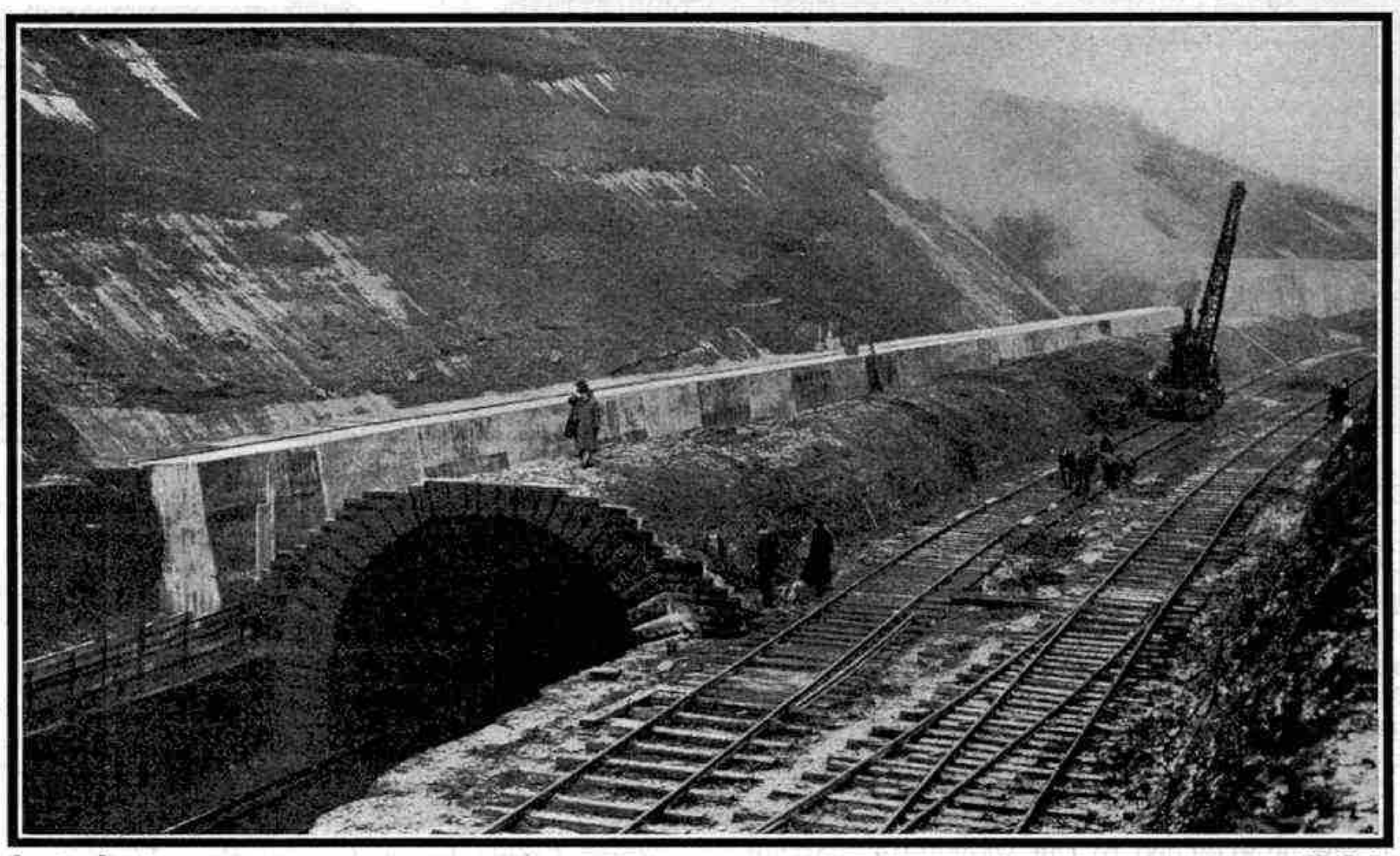
Courtesy] [*L.M.S.*

The north end of Crewe Station, showing at the left the remarkable Suspension Bridge that spans the track and connects the station with the nearby locomotive works

The Manchester portion, which has left London Road at 10 a.m. and called at Stockport, makes the level 25-mile run from the latter town in half-an-hour, and follows us in at 10.40 a.m. When all the marshalling has been done, we are, or should be, ready to leave for the south at 10.47 a.m. The "*Merseyside Express*" has rolled in before we leave, at 10.40 a.m., with its "Royal Scot" at the head. As far as Birmingham our engine is one of the four-cylinder 4–6–0 "Claughtons," and it is not unlikely that we may enjoy the services of one of the latest large-boilered "re-builds," of the type illustrated above.

If we have as many as 14 coaches out of Crewe, the total weight behind the tender will be, in all probability, a little over 400 tons, perhaps 420 or so. The going will be heavy up to Whitmore, there being three miles rising at 1 in 177 from Betley Road to Madeley; but having completed the 10½ miles to the summit point in 16 or 17 minutes, we shall cover the next 14 miles to Stafford in "even time," passing the latter in just over the even half-hour. Water is taken from the track-troughs at Whitmore, which are the last that we shall see in the course of this journey. Trains for the Birmingham direction at Stafford have the advantage over the London expresses that they do not have to reduce speed at Trent Valley Junction. The earliest route from London to Stafford and the North was, of course, by the "London and Birmingham Railway" to Birmingham, and on from there; the Trent Valley line from Rugby to Stafford through Nuneaton, Tamworth and Lichfield was made at a considerably later date.

We hurry past the beautiful old Shropshire town of Penkridge, with its mass of red-tiled roofs, and presently prolonged whistling, the presence of large marshalling sidings, and locomotive sheds on the left of the line advertise the near approach of a large town. These are Bushbury sheds and the town is Wolverhampton. Until last October the southbound "*Pines Express*," like the northbound train, avoided Wolverhampton, taking the original route through the eastern outskirts of the town to Darlaston, Bescot (midway between Walsall and Wednesbury), and then over the Soho Road spur on to the present main line again, so to reach New Street. But now we diverge to the right at Bushbury, sweep up the incline over the Great Western Birmingham and Chester main line, with a fine view of the Oxley engine-sheds, and so into the High Level station at Wolverhampton. The 39¾ miles from Crewe here are allowed 50 minutes, and we are due at 11.37 a.m., for a stop of three minutes.



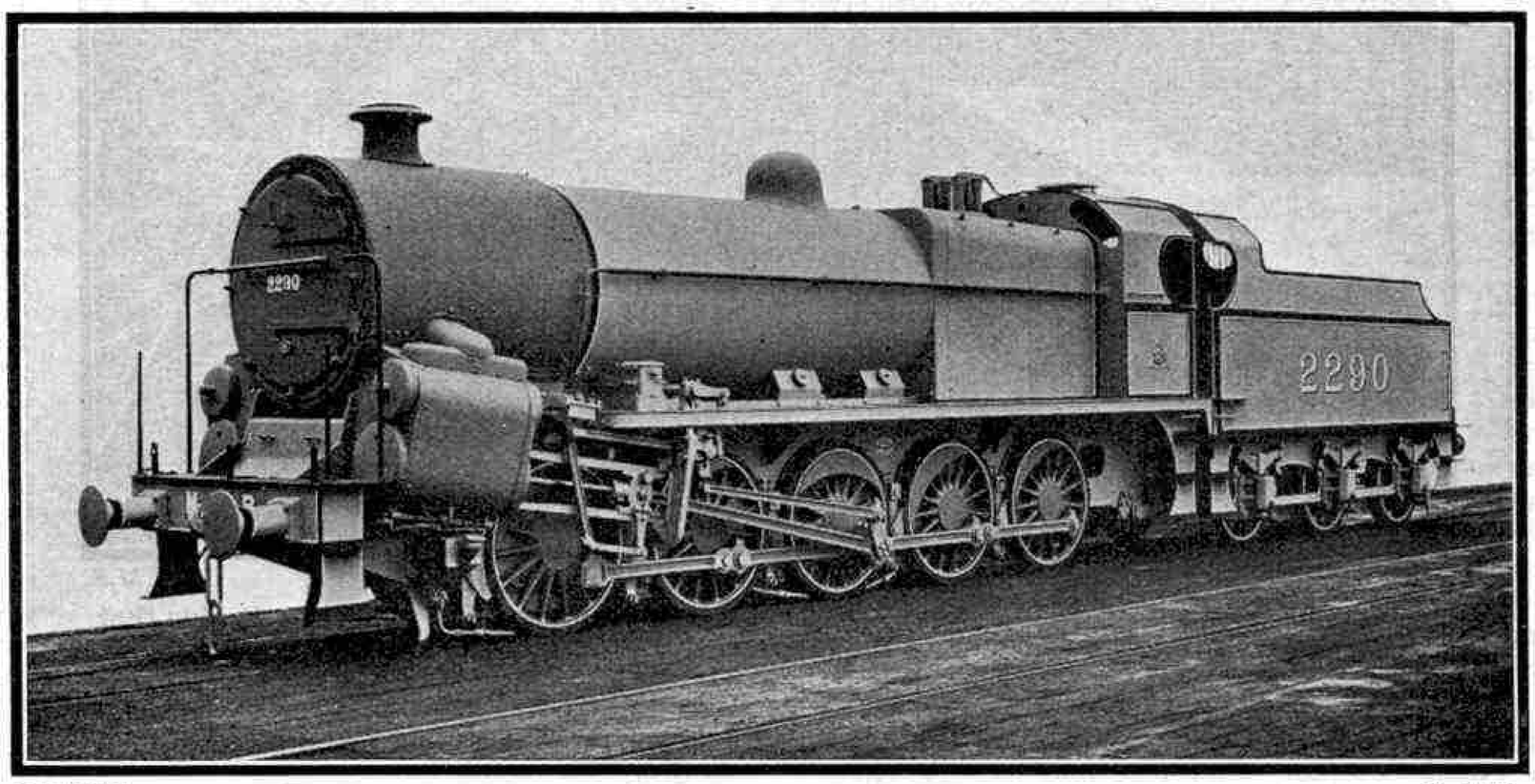
Courtesy] [*L.M.S.*

The Cofton Tunnel at Barnt Green, near Birmingham, before it was demolished by explosives to form a cutting. It was blown up in three lengths of about 50 yards each

Over the next 13½ miles of the journey the veil is best drawn. It is through the heart of the "Black Country," and black it is, in very truth! Iron and steel articles in vast quantities are made in the area bounded by Wolverhampton and Birmingham in the one direction, and Dudley and Walsall in the other. For example, fully 90 per cent. of the galvanised steel chair-screws used by British railways, to the tune of millions every year—and they are no "pocket" screws, either, as each one weighs just over 1½ pounds—are made within a radius of three miles from where we are running at the moment, just south of Wolverhampton. Blast-furnaces are seen on every hand, but most of them, unfortunately, have gone out of use, other districts, such as Tees-side in Yorkshire, being for various reasons able to produce the iron more cheaply. Dudley Castle is seen on the hill away on the right, as we run through Dudley Port. Finally, after passing through a very smoky tunnel, which is an awkward bottle-neck at this end of New Street Station, we run into the latter, 20 minutes after leaving Wolverhampton, at precisely 12 noon. Here our "Claughton" is detached, together with the four-coach corridor "set" that has come down from Liverpool, and replaced by a Midland 4–4–0 or, if the train is sufficiently heavy, with two.

As mentioned earlier, we are going to leave New Street in the "wrong" direction altogether for Bournemouth, as departures of Midland Division trains from this end of the station are for Derby and the North, while the Western Division expresses leave this way for London. But when we get as far as Grand Junction we make a sharp divergence to the right, in order, at St. Andrew's Junction, to get on to the direct line that the Midland built, avoiding Birmingham altogether by giving a straight run from Saltley to King's Norton through Moseley. An important service of Birmingham suburban trains runs round this way, and it is also used by all the Midland freight traffic between North and South, which is thus kept out of New Street; but our southbound "*Pines Express*" is the only fast train making regular use of this route. After mounting some heavy gradients we join at King's Norton the main line that has come out of New Street by Selly Oak and Bournville—where Cadbury's great chocolate works is situated—having in this way completely reversed our direction of running. We left New Street at 12.8 p.m., and are due to pass King's Norton at 12.22 p.m. Beyond here we notice the recently-completed widening of this main line.

After running a bare seven miles farther, despite the fact that all signals are off we are brought momentarily to a dead stand at a station called Blackwell, at 12.32 p.m. We have reached the head of the famous Lickey incline, which is for two miles inclined at the formidable figure of 1 in 37¾. All trains, whether passenger or freight, are compelled to halt there, the former to test the brakes and see that they are in proper working order, and the latter to pin down sufficient of the wagon brakes to ensure a safe descent. Acceleration after starting is, of course, tremendously rapid, and our driver has to apply his brakes frequently in order to keep the train under proper control. The incline is, however, almost perfectly straight from top to bottom.



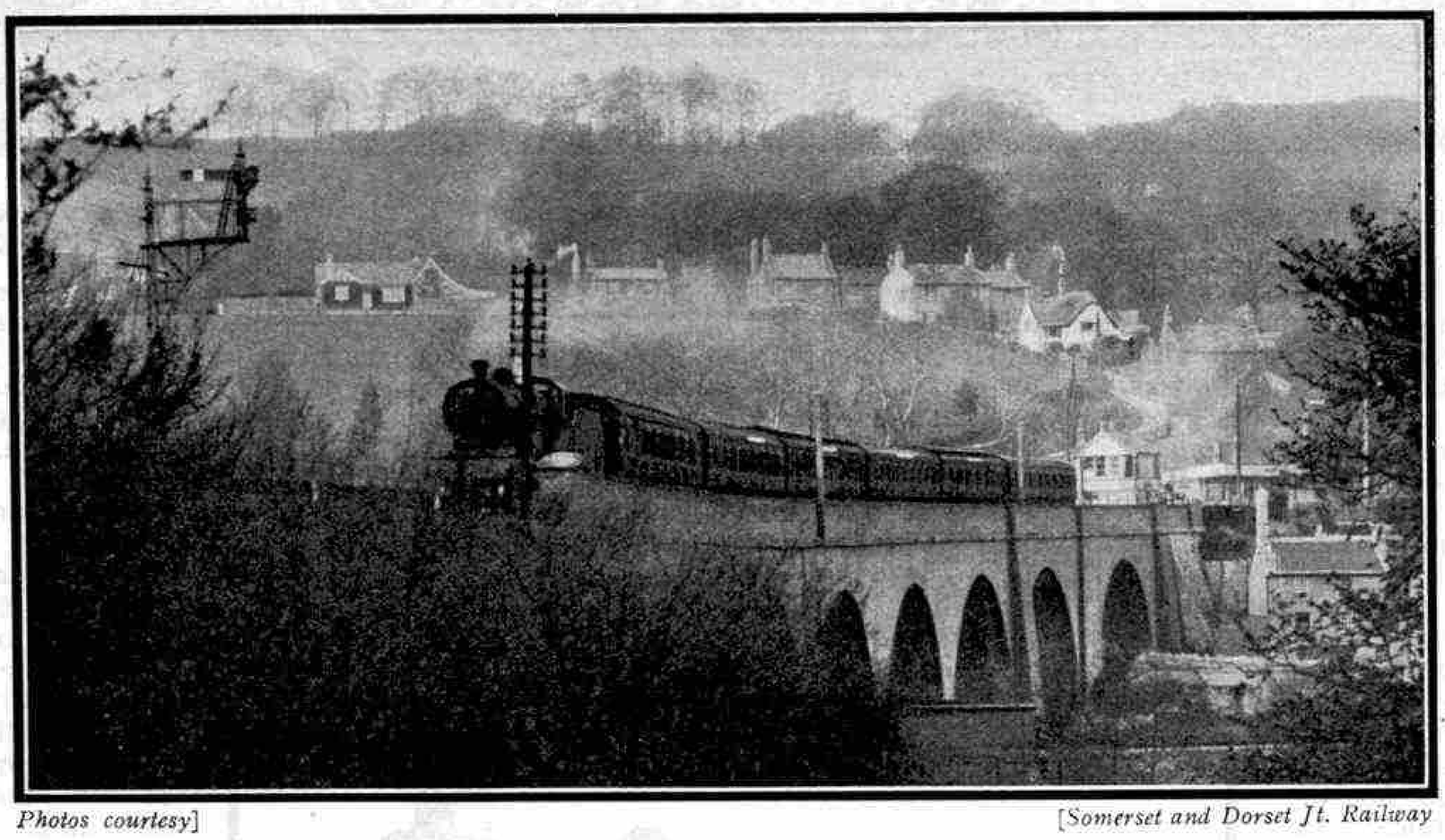
Courtesy] [*L.M.S.*

The famous "*Lickey Banker*," No. 2290, built by the Midland authorities at Derby for banking trains up the two-mile Lickey incline

At the foot lies the station of Bromsgrove, and here we should keep a sharp look-out to the right, in order to see in the sidings the only ten-wheels-coupled locomotive in the British Isles. No. 2290—the "*Lickey Banker*"—was built by the Midland authorities at Derby for the sole purpose of banking trains up this two-mile incline. Every northbound train has to stop at Bromsgrove for assistance and, in the case of passenger or freight trains of any weight, two 0–6–0 tank engines, coupled together, perform the banking duty. No. 2290, which has four cylinders 16¼ in. diameter by 28 in. stroke, and 10-coupled wheels, undertakes the same duty single-handed. It is probable that for so very short a run a tank engine design would have been employed, as in

the Great Eastern Railway "Decapod" of 1903, were it not considered that side-tanks and a coal bunker on the main frames would have made No. 2290 too heavy for the track.

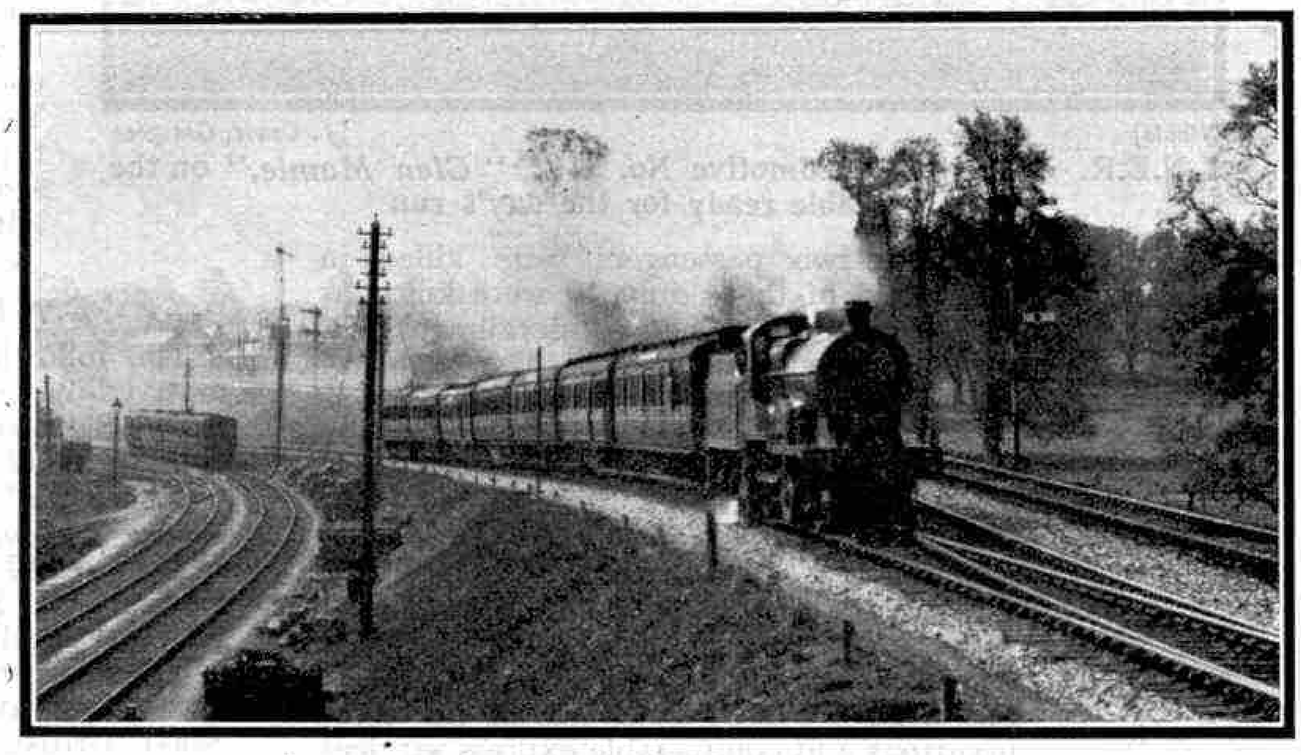
The next 25 miles, to just beyond Ashchurch, form a fine "galloping ground," mostly either level or slightly downhill; and over this length we should maintain an average rate of a little more than a mile a minute. From Stoke Junction, two miles from Bromsgrove, to Abbot's Wood Junction, near Worcester, we run over a direct line avoiding the latter city, which is distinguished by affording the longest continuous stretch of track without any intermediate station that is to be found in the British Isles—the 14½ miles from Bromsgrove to Wadborough. So we hurry down the valley of the Severn — though not actually seeing the river—through Defford, Bredon and Ashchurch, where the line from Evesham to Tewkesbury makes, with our main line, one of the rare level crossings of one railway over another that are to be found in this country. Soon after passing Cleeve we shut off steam, and at 1.13 p.m. we pull up at Cheltenham Spa. The 47¼ miles from Birmingham have taken us 65 minutes, and the 31 miles from Bromsgrove 36 minutes.



Photos courtesy] [*Somerset and Dorset Jt. Railway*

The "*Pines Express*" crossing Midford Viaduct, Somerset and Dorset Joint Railway

From Cheltenham it is but a short run of 6½ miles to Gloucester, allowed 10 minutes. All expresses over the West of England line of the L.M.S. stop at both places, except during the height of the summer. Just after we leave the Lansdown Station at Cheltenham, the Great Western Railway comes in on the left, and from there to Gloucester the trains of both companies run over the same joint metals. These trains include the Birmingham and Bristol expresses of the G.W.R., which run along the same track as the L.M.S. Birmingham-Bristol trains as far as the Engine Shed Junction at Gloucester. They avoid that city, but presently are seen travelling alongside the L.M.S. lines again to Standish Junction, near Stonehouse, where they transfer on to the L.M.S. line over which we shall presently run, and follow it for 20 miles to Yate. Here they pass round a connecting spur on to the Badminton line of the G.W.R. at Westerleigh, using that into the same station at Bristol—Temple Meads—as the L.M.S. expresses, in the reverse direction of that by which we travelled to Paddington last month by the 5.15 p.m. up two-hour Bristol express. But this is a digression.



The "*Pines Express*" at Templecombe No. 2 Junction, S. & D. Jt. Rly.

We reach Gloucester at 1.28 and leave at 1.36 p.m. For a long distance the Cotswold Hills rise like a great rampart on our left hand, and the hills of the Forest of Dean are seen across the Severn Valley on the right. There are some sharply rising grades out of Gloucester, partly at 1 in 104 and 108, to Standish, seven miles away, for most of which distance, as previously mentioned, the Great Western line from Gloucester to Swindon and Paddington runs alongside. Not infrequently, too, the trains of both companies are seen doing a thrilling "neck-and-neck" along here. The next 10 miles are mostly falling, and then there is a rise for 7½ miles past Charfield and Wickwar; but the gradients in both cases are mostly moderate, between 1 in 250 and 300. At Mangotsfield North Junction, 31½ miles from Gloucester, which we pass at 2.17 p.m., we slow severely to diverge from the Bristol main line on to the Bath branch. Presently we find ourselves in the Avon valley, with Brunel's old main line from London to Bristol by Bath on the right, and at 2.31 p.m. we draw up in Queen's Square Station at Bath, having covered the 41 miles from Gloucester in 55 minutes.

Queen Square Station is terminal, so that the blue Somerset and Dorset locomotive that is to complete the journey of the "*Pines Express*" comes on at the other end of the train. It is of the 4-4-0 type, built, like most of the recent engines of this railway, at the Derby works of the L.M.S., and conforming almost exactly in type and appearance to the Midland "Class 2" engines. In view of the tremendous gradients over which we are about to travel, it is singular that the S. & D.J. management have never adopted any more powerful design for their passenger work. The Midland compounds have been tried over the route and, still more singular, Derby has built for hauling coal trains over the S. & D. more powerful locomotives—of the 2–8–0, or "Consolidation" type—than any ever built for its own Midland freight services. Be that as it may, our engine is not allowed to tackle more than 185 tare tons without assistance, and the chances are that, if our train still exceeds six coaches, unless some light stock in the formation brings seven within this limit, we shall have to take a pilot locomotive to the summit at "18¼ miles," between Binegar and Masbury. This pilot probably will be a 0–6–0 freighter of the standard L.M.S. type (of which the S. & D. owns a number) fitted with the passenger brake for mixed traffic working.

Directly we are past Bath Junction and on to the single line, the gradient begins. There are no half-measures about it, either; it begins at 1 in 80 and soon steepens to 1 in 50! We rise over the Great Western main line and presently enter Devonshire Tunnel. Shut your carriage windows here and pity the unfortunate crews on the engines, who are having no enviable task in the suffocating atmosphere produced by two hard-worked engines in the narrow confines of this single-line bore, although it is fortunately short. At 2½ miles out of Bath the grade changes, and the engines have some respite; for over a mile of the distance this is through Coombe Down Tunnel. At Midford we pass on to double line again and at Radstock, 10½ miles out, we find we are passing through the heart of the Somersetshire coalfield, the pitheads looking singularly out of place amidst such lovely country. Climbing now recommences in earnest. Altogether some eight miles at between 1 in 50 and 80 have to be faced, until we attain the crest of the Mendips just before Masbury, (*Cont. on page 495*)



S.R. Locomotive News

An interesting new series of tank locomotives designed by Mr. R. E. L. Maunsell, C.B.E., Chief Mechanical Engineer, S.R., are now being placed in service. They have been built at the Company's works, Brighton, and are to be used in goods yards and sorting sidings. The standard Central Section boiler is used and it is well adapted for the purpose of shunting as it has a large steam and water capacity. These locomotives have three cylinders in conjunction with four pairs of coupled wheels 4 ft. 8 in. in diameter, thus giving a large tractive effort for a moderate engine weight and wheelbase. Two Walschaerts valve gears are used for the outside valves, while for the middle valve a modified form of Walschaerts gear has been adopted. The drive is divided, the outside cylinders being connected to the third axle and the inside cylinder to the second. The tanks have a water capacity of 1,500 gallons, while the bunker holds easily three tons of coal. The engines are known as the "Z" class, and are numbered A.950 to A.957.

It is interesting to note that there is now only one remaining engine in the old Brighton livery and this is the E.1 class (Stroudley) tank No. 607B. This locomotive was built at Brighton in October 1876, and still has a boiler of Stroudley design.

* * * *

Runaway Train on L.N.E.R.

An exciting occurrence took place at Spalding L.N.E.R. Station, while the driver and fireman of a goods train were examining the rear of the locomotive. Suddenly the train started to move, and before either of the men could board the runaway it was travelling up the line towards Sleaford. After running uncontrolled as far as Helpringham, 15 miles from Spalding, the engine came to a standstill owing to lack of steam. Fortunately the line was clear.

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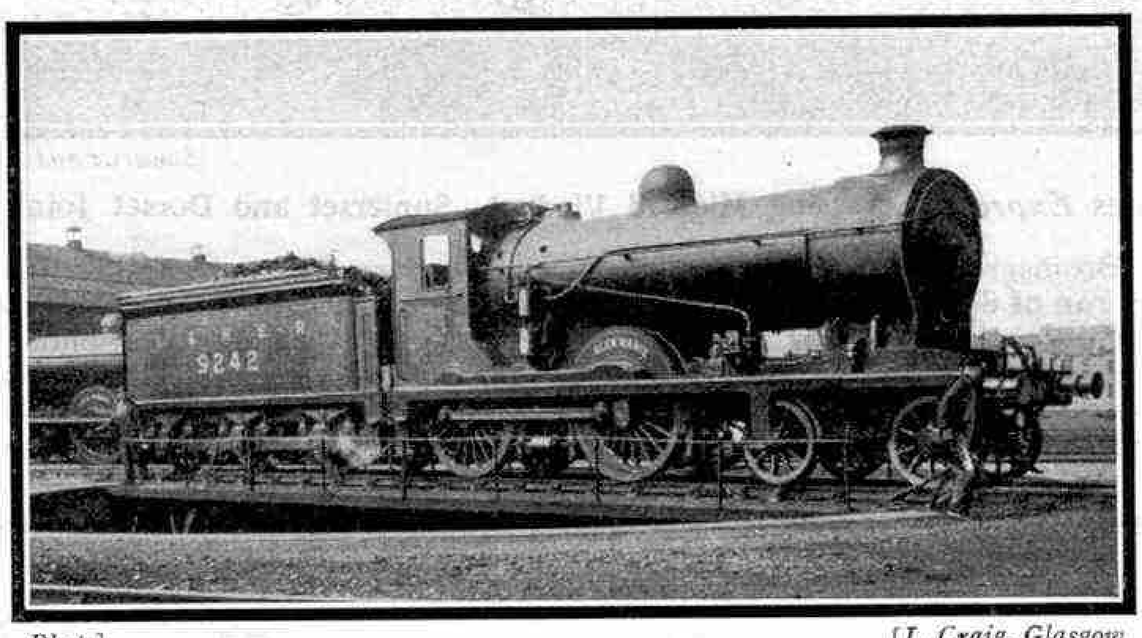
Longest Railway Platform in Europe

Manchester and Salford have achieved the distinction of being the only two cities in the world to be joined by a railway platform. This unique platform connects the Victoria and Exchange stations, and was officially opened by the "Railway Queen," Miss Ena Best. It is the longest in Europe, being half a mile in length. We hope to give details of this interesting platform in a future issue.

Passenger Safety in America

In 1927 the number of passengers killed in American railway accidents averaged 1.047 per 10,000,000 passengers carried, or slightly more than one passenger for every 10,000,000 carried. The corresponding figure for 1926 was 1.749, and for the three years ending with 1925 it was 1.598.

Ten years ago, the corresponding average was 2.711; twenty years ago, 6.978; and thirty years ago, 4.535, from which figures it will be seen how great an improvement has been made in the safety of passenger travel.



Photo] *[J. Craig, Glasgow*

L.N.E.R. 4-4-0 type locomotive No. 9242, "*Glen Mamie*," on the turntable ready for the day's run

Eighty-two passengers were killed in 1927, and of these only 10 were killed as the result of collisions, derailments or other accidents to trains. The majority of the 82 fatalities occurred to persons who were getting on or off cars, or who were struck by trains at stations.

* * * *

New "Blue Train" Service

With the inauguration of a new "Blue Train" service between Calais and the Mediterranean coast of France, Europe has been provided with one of the most luxurious and comfortable express services in existence. The trip from Calais to Nice requires about 20 hours' travelling.

Each coach of the new train consists of 10 single-berth compartments. As there are no two-berth compartments, arrangement is made so that in case two people are travelling together two single compartments may be joined by the opening of a large door between them, thus giving the travellers free access to a space about 10 ft. in length in place of the single-compartment length. Elaborate decoration throughout and furnishings of the highest quality help to make a trip in one of these coaches a very pleasant experience.

Electric Colliery Locomotives for the Far East

Seven trolley locomotives have been designed and built recently by Greenwood & Batley Ltd., Leeds, for use in coalmines in the Far East. They are now under test and will be delivered shortly. Their dimensions, 10 ft. 3 in. long by 2 ft. 9 in. wide, are determined by the size of the pit cages. Each locomotive has to draw either a 60-ton train, or 40 tubs of coal and five tubs of stone, and to exert a normal tractive effort of 2,000 lb. when travelling at a speed of 6¼ miles an hour. On test the maximum tractive effort actually developed is about 3,000 lb.

The locomotives weigh about 3½ tons each without ballast, and ample room is provided for 30 cwt. of ballast. They are built to run on an 18 in. gauge track composed of 25 lb. rails, and are fitted to take direct current from overhead conductors carrying a pressure of 550-600 volts, the "pick-up" being by means of a spring-loaded reversible pantagraph collector. Each locomotive is equipped with two 18-20 H.P. enclosed weather-proof motors. The controller is of the tramway-type and has seven running speeds in either direction, in addition to two braking notches.

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G.W.R. Locomotive News

The following new "Hall" class locomotives have been turned out recently from Swindon: Nos. 4911, "*Bowdon Hall*"; 4912, "*Berrington Hall*"; 4913, "*Baglan Hall*"; 4914, "*Cranmore Hall*"; 4915, "*Condover Hall*"; 4916, "*Crumlin Hall*"; 4917, "*Crosswood Hall*"; 4918, "*Dartington Hall*"; 4919, "*Donnington Hall.*" In addition, 2–6–2 T's Nos. 5570–74 have been completed, while the following new locomotives have been built by the North British Locomotive Company Ltd., and placed in service:—Goods 0–6–0 T. Nos. 5708–17, 5730–35 and 5737. "Hall" class engines are now working most of the passenger trains between Plymouth and Penzance, except the "*Cornish Riviera.*"

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L.N.E.R. Locomotive News

New 1929 "*Shires*," Nos. 352, "*Leicestershire*"; 2755, "*Berkshire*"; 2756, "*Selkirkshire*"; and 2757, "*Dumfriesshire*" have been noted in service. No. 2758, "*Northumberland,*" is now in service also. The name given to No. 2754 "*Shire*" class locomotive is "*Rutlandshire.*"

Hudson Bay Railway Reaches Churchill Harbour Terminus

The railhead of the Hudson Bay Railway has now reached its terminus, Churchill Harbour on Hudson Bay. A vast amount of work still remains to be done in the way of providing port facilities, and it is not expected that grain shipments will be practicable in less than a year.

In 1910 a branch line of the Canadian Northern Railway was completed from Hudson Bay Junction on the Winnipeg-Prince Albert Section and The Pas on the Saskatchewan River, and the building of a Government line from The Pas to Hudson Bay was then authorised. In the following year work on the Hudson Bay Railway commenced, the terminal point chosen being Churchill. Later, however, it was decided to make Port Nelson the terminus, and considerable progress was made with a line having this place as its objective. These operations were brought to a standstill during the War and were not actively resumed until 1926, by which time a good deal of the existing construction work had deteriorated to such an extent that it was practically useless.

At this stage the respective merits of Nelson and Churchill began to be strongly debated and finally, in order to settle the matter, Mr. Frederick Palmer, an English engineer, was engaged by the Government to investigate the matter and submit a report. In due course Mr. Palmer's report was put forward and it was strongly in favour of Churchill as a terminal point.

Churchill possesses excellent natural breakwaters of rocky cliffs enclosing a harbour some six miles in length and from one to 2½ miles in width at low water and 1½ to four miles at high water. The wharf will be situated in a thoroughly sheltered part of the harbour, and it is not anticipated that there will be any difficulty in maintaining a deep water channel.

* * * *

Longest Railroad in U.S.A.

The recent acquirement of additional lines in Kansas and Texas is said to have made the Santa Fé the longest railroad in the U.S.A., slightly exceeding its nearest mileage rival, the Southern Pacific System, which has 13,165 miles of track. Other long lines in the United States include the Pennsylvania Railroad, 10,527 miles; and the Chicago, Milwaukee, and St. Paul Railway, 11,193 miles.

* * * *

French High-Speed Experiment

An interesting experiment in high-speed railway travel was carried out between Paris and Cherbourg recently with a view to providing a quicker connection between the capital and the trans-Atlantic port. The journey was accomplished in 3 hours 18 minutes, making an average start-to-stop speed of 72 miles per hour.

Baltimore and Ohio Engine's Long Run

The longest known run of a coal-fuelled locomotive in high speed passenger service was recently completed upon the arrival of the Baltimore and Ohio train No. 10, from Chicago to Washington, a distance of 786 miles. The locomotive that performed this feat was the "*President Pierce*," No. 5312, one of the 21 locomotives in Baltimore and Ohio service named after the Presidents of the United States. Ordinarily four engines are required in successive relays to make the run between Chicago and Washington, and up to three years ago it was necessary to use five engines over the route. On this occasion the "*President Pierce*" hauled 14 cars to Willard, Ohio, and 10 cars to Washington.

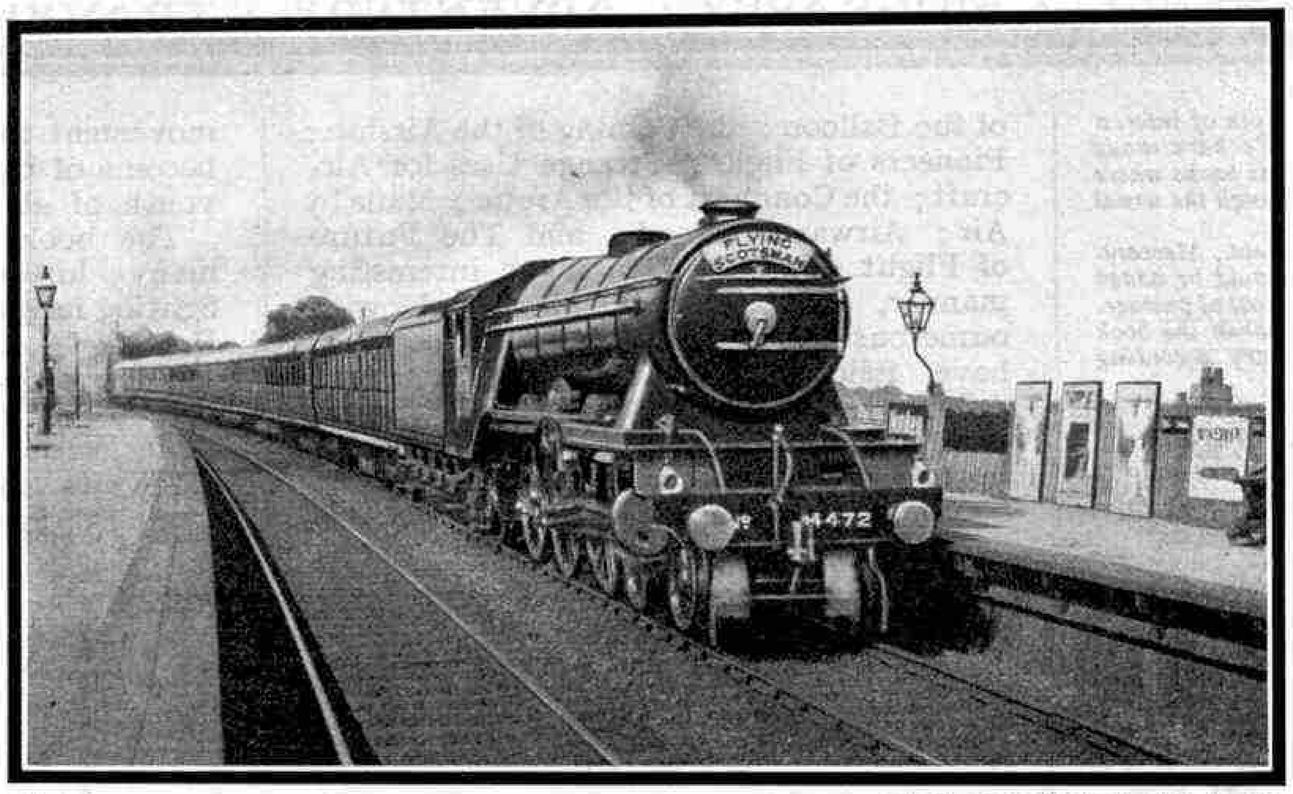
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Railway Losses through the Great Frost

During the severe frosts early in the year the railway companies suffered enormous losses. Local shipments at the G.W.R. South Wales Docks dropped from 579,938 tons for the week ending 10th February to 281,376 tons in the following week. Coal appliances were frozen, and small coal became a solid mass that had to be dug from the wagons with pick-axes! Wagons were held up and the supplies from the collieries so delayed that at one time no less than 89 vessels were waiting for tips. These delays represented thousands of pounds lost to the company. When the thaw came, however, the facilities available enabled all arrears to be overcome, and in three weeks' time there were vacant berths at several ports.

* * * *

A scheme of railway construction embodying a total of nearly 10,000 miles of line has recently been formulated by the Chinese Minister of Railways.



Photo] [*J. J. Cunningham, Edinburgh*

Up "*Flying Scotsman*" at speed on its non-stop London-Edinburgh schedule, passing Longniddry, near Edinburgh. Locomotive, No. 4472, "*Flying Scotsman*"

G.W.R. 0-6-2 Goods Tank Engines

The following is a list of locomotives of the above type, together with the year in which they were built:—5600-5603, *1924*; 5604-5649, *1925*; 5650-5684, *1926*; 5685-5699, *1927*; 6600-6618, *1927*; 6619-6649, *1928*.

Fifty tank engines of this type, in addition to the above, were ordered from Armstrong Whitworth & Co. Ltd., of Newcastle-on-Tyne, and by the time this statement appears in print all these will have been delivered. Forty-five have already been constructed and sent to Swindon. The numbers of the first 45 run from 6650 to 6694. The weight of these engines is 69.35 tons.

* * *

Renamed G.W.R. "Castles"

The following is a list of the G.W.R. "Castle" class 4–6–0's, the original names of which have been changed. This list gives their present names and numbers:—5004, "*Manorbier Castle*"; 5005, "*Newport Castle*"; 5006, "*Ogmore Castle*"; 5007, "*Oystermouth Castle*"; 5010, "*Swansea Castle*"; 5012, "*Wallingford Castle.*"

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Isle of Wight Railway Notes

Considerable alteration has taken place in the designing of locomotive whistles used on the Southern Railway lines in the Isle of Wight. A type of hooter is being adopted that reminds one very much of that used by the old Isle of Wight Central Company.

Engines now being turned out by the Ryde Shops bear red number plates on the back of the bunker. All engines are now to carry a number on the bunker sheet instead of on the tanks as formally.

The eight-wheeled Metropolitan coaches have been laid up throughout the winter as they are not steam-heated, but some of them will probably be used extensively this season to help with the holiday traffic.

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"Royal Scot" Locomotives

The L.M.S.R. have hit upon the happy idea of attaching brass plates bearing an imprint of one or other of the earlier locomotives to engines of the "Royal Scot" class bearing the same name. For example, No. 6146, "*Jenny Lind*," will have below the usual name plate a line representation of the engine of the same name built for the Midland Railway in the year 1847.

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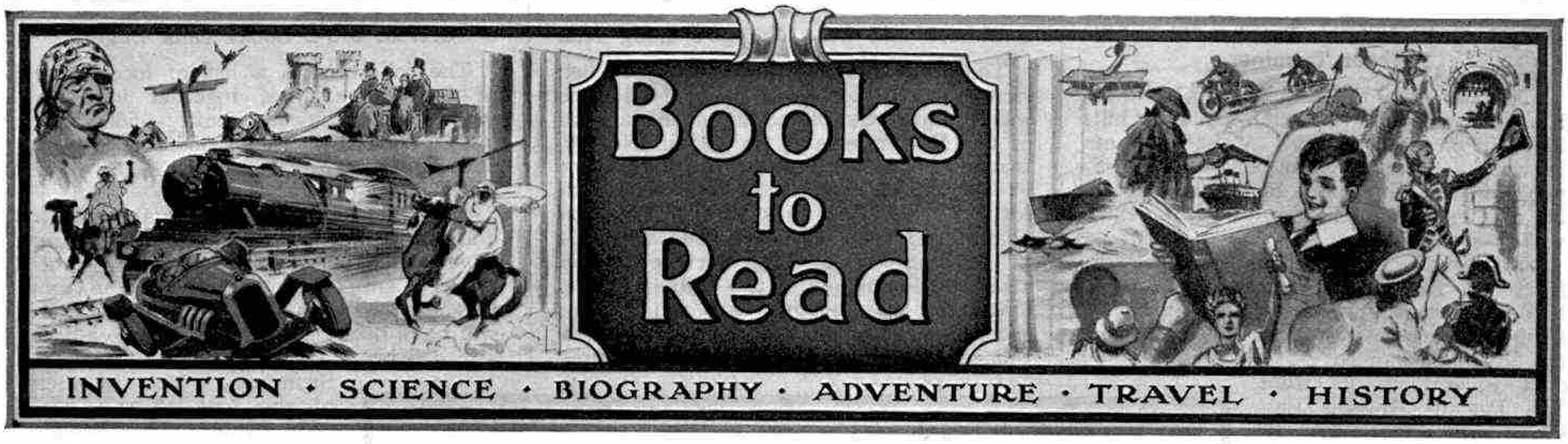
Station Lighting on the C.L.R.

It is stated that the station lighting system on the Central London Railway is shortly to be converted from direct current at 600 volts to alternating current at low voltage. The cost of this change-over will be approximately £40,000, and the new system will provide a current supply that will be suitable also for automatic train indicators and ticket-issuing machines.

DIFFICULTIES EXPLAINED

X.—Small Numbers on L.M.S. Cab Sides

On the upper portions of the cab sides of London Midland and Scottish locomotives are to be seen certain small numbers. The object of these is to indicate the particular engine shed to which each locomotive is allotted. The numbers do not appear on locomotives belonging to companies other than the L.M.S.



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Stories of Engineering Adventure"

By E. Cressy (F. Warne & Co Ltd. 7/6)

The chapters in this volume were originally given as broadcast talks, and some of our readers may therefore have heard them. Except for the addition of illustrations and a few alterations the book is identical with the talks.

The first section of the book contains three chapters on the Early History of Railways, three on Trans-Continental lines, and three on railways with some special features.

The second section of the book deals with the growth of the ship, from the floating log to the luxurious ocean-palace of to-day. Here we have the story of the Ancient World and of the Middle Ages, followed by the ships of Queen Elizabeth's time and some account of the East Indiamen and the China "clippers." The coming of the steam and iron brought an enormous difference in the increase of size, speed, and power of the ship, with a consequent development of trade.

The subject of the third section is the great canals of the world, and we visit in turn:—France, England, Egypt, America, Germany, Holland and Belgium. We are able to picture the part that artificial waterways play in the transportation of the world's goods and merchandise. We learn, too, of the difficulties and dangers that had to be faced by the early engineers and of the hardihood and courage, and frequently of the heroism with which these difficulties were faced and overcome.

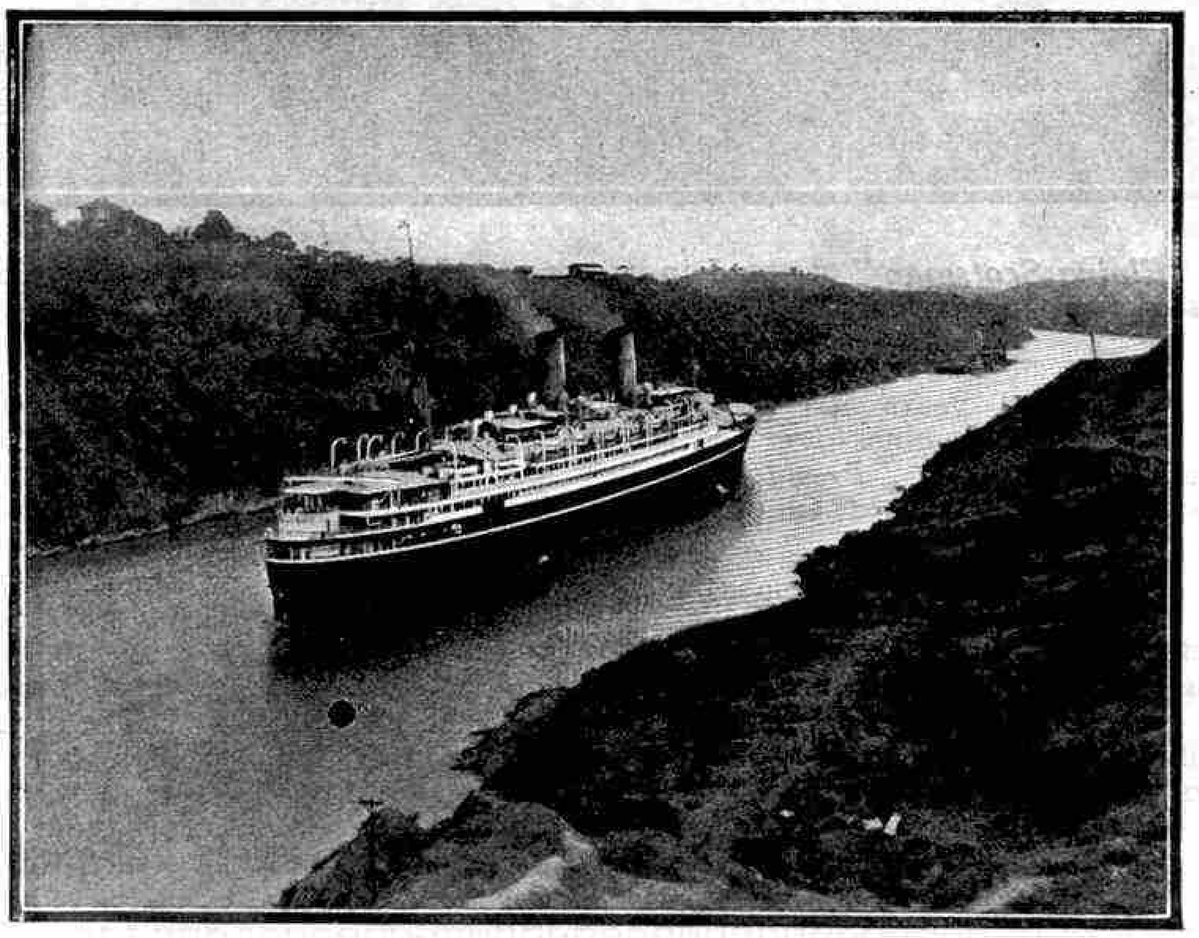
There are 24 illustrations and photographs, and 12 maps and diagrams in the text.

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"The Romance of Flight"

By G. Gibbard Jackson (Religious Tract Society. 5/-)

This is a book for the reader who is more interested in the history of aircraft than in the technical side of the subject. It deals with such interesting subjects as the Beginnings of Flight; the Romance of the Balloon; the Coming of the Airship; Pioneers of Flight; Strange Uses for Aircraft; the Conquest of the Arctic; Mails by Air; Airways Abroad; and The Future of Flight. It is written in an interesting manner, and is well illustrated with numerous photographs. To those who have followed our series of articles: "Conquest of the Air," the book will, no doubt, strongly appeal. The author is already well-known as a writer of interesting books, having several volumes to his credit.



The "*Empress of France*" passing through the Culebra Cut on the Panama Canal. (From "Stories of Engineering Adventure" reviewed on this page)

"A Boy's Life of Baden Powell"

By John G. Rowe (The Epworth Press. 2/-)

This volume, one of a series of popular life stories, will be welcomed by all our readers, and more especially so by those who are Scouts. The story of the Chief Scout's life is a thrilling romance, and few people have had more exciting experiences of all kinds. To those who remember the South African War, "B.P." will probably always remain famous as the hero of Mafeking. In this book the story of the siege is told again and we read of "B.P.'s" many ruses to deceive the Boers, until the relief column—sent out by Lord Roberts—relieved Mafeking, after it had been besieged for 217 days.

If "B.P." were merely General Baden Powell, and not the Chief Scout, his story would be almost unrivalled as a record of activity and service to his country. But in addition to the debt that Britain owes to him, the whole world is indebted to him for his inception of the Boy Scout movement in 1906—a movement that has become of the greatest importance to the youth of all nations.

The book is good reading and covers many historical events—such as the fighting in Zululand, Ashanti, the Matabele Rebellion, etc.—in which "B.P." took an active part. It brings Sir Robert's life "right up to date," the last events dealt with being the monster Rally of Scouts and Guides at York, and the coming-of-age of the Scout movement.

* * *

"Hunting Under the Microscope"

By Sir Arthur E. Shipley, G.B.E., F.R.S. (Benn Bros. Ltd. 8/6)

Those who are interested in studying the beauties of Nature can obtain a good deal of fun with the aid of even a small microscope. In a few drops of water from a pond there are some of the most wonderful creatures—wonderful, not only because of their delicate beauty, but also because of their minuteness. This book, the last to have been written by the late Sir Arthur Shipley, shows how the wonders of animal life may be discovered from the smallest organisms. As its author says, it was written for "the public that is not preparing for examinations and, thank heaven, that public is still in the majority!"

Sir Arthur has a wonderful story to tell of a world in which tiny creatures move and exist in a manner not unlike those of the larger forms of animal life. He records, among other things, some interesting experiments with "slipper animalcules." If these tiny creatures are kept long enough in certain circumstances they eventually show signs of breaking up. This may be averted, however, for a while by feeding them on beef tea or alcohol, or, curiously enough, by the jolting of a railway journey. The tiny octopus of the pond, known as *Hydra*, is capable of withstanding many drastic surgical operations, but Sir Arthur tells us that chloretone, which is used by human beings as a preventive of sea-sickness, causes the little *Hydra* to have such a violent attack that it virtually yields up its "very innards"!

The present little volume is a fitting companion to Sir Arthur's previous volume, entitled "*Life*." There are few books from which readers of the "*M.M.*"—endowed with unlimited curiosity and, perhaps, limited scientific knowledge—

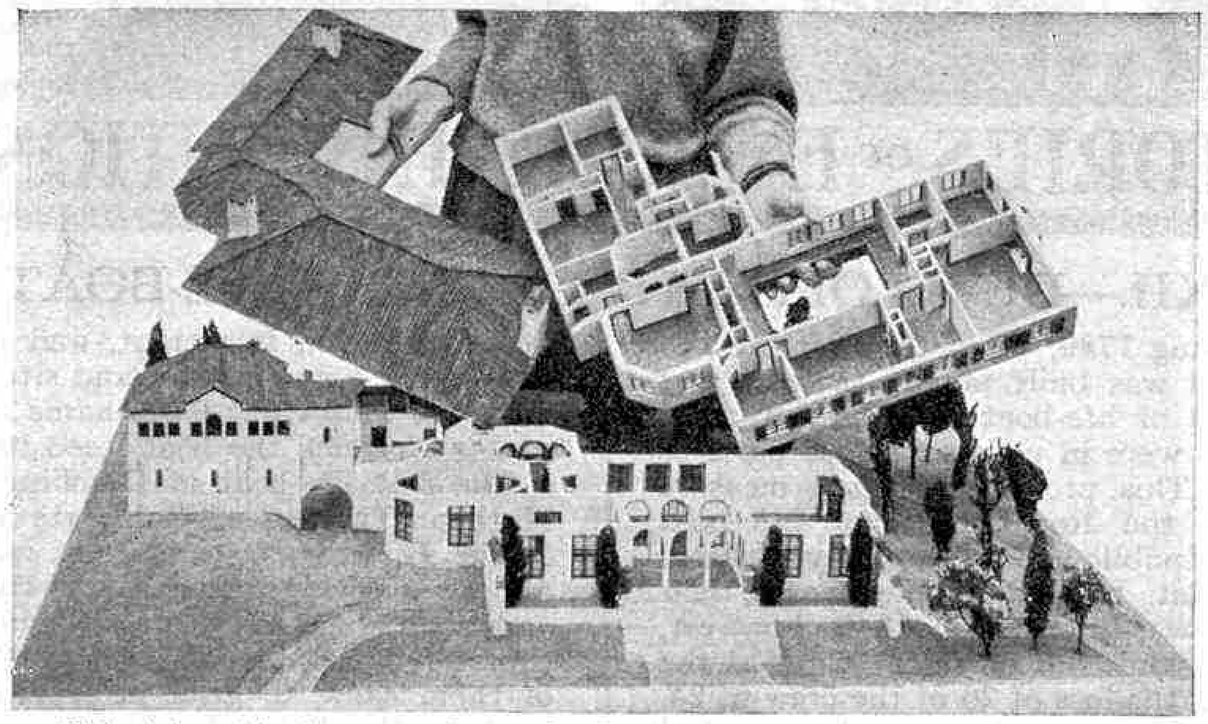
can learn as much of the nature of living things than from these two admirable and thought-provoking books. Not only had Sir Arthur an extremely wide knowledge of Biology, but he had a universal gift of lucid explanation. What is even more rare in an eminent scientist is the possession of a delightful sense of humour, which he did not hesitate to use effectively to drive home his points.

* * *

"Models of Buildings"

By WILLIAM HARVEY
(Architectural Press. 7/6)

Model-building as a hobby is a comparatively recent development, and it is astonishing how wide a range it has covered during the past few years. Meccano model-building is known to everybody, and to a smaller degree so is also the building of model ships. An even more recent phase is the design and construction of model houses and buildings of all kinds. Possibly at first sight the building of a model house may not seem particularly interesting, but once a model is started the fascination grows and grows until the builder cannot rest without introducing every possible detail.



(Below) A model of a country house, showing how a very natural effect may be obtained in this class of work.
(Above) The same model but opened up for inspection of the interior rooms on the ground and first floors. The model is made of plywood, either painted or stained. Natural twigs and pieces of loofah, carefully tinted, are used for trees around the house. (From "Models of Buildings" reviewed on this page)

Model-making is undoubtedly a necessary part of architectural design. An architect may produce a wonderfully detailed drawing of a building that he proposes to erect, but yet this produces little impression on the mind of the average person who has had no training in reading scale drawings. If the architect produces a model of his proposed structure, however, the position is immediately altered. The model is a miniature of the real thing, and everyone who sees it instantly forms a correct and complete mental impression of what the full-sized structure will be like. The material required for the construction of models of buildings is very varied, but it has the outstanding merit of being extremely cheap. Even paper may be used with effect, and as we pass on to cardboard and wood the scope grows enormously. Model bricks are of great value, and such materials as Plasticine have almost unlimited possibilities.

A certain amount of instruction is needed in order to produce first-class models of this nature, and with the object of helping beginners Mr. W. Harvey has written a book that deals with the subject in full detail. Every branch of the work is given consideration, and the numerous illustrations have been chosen to illustrate almost every problem likely to be encountered. It is particularly interesting to notice that the author has found Meccano parts of the greatest possible value in the building up of frameworks to carry walls constructed of Plasticine or clay. We can strongly recommend this book to any model-building enthusiast in search of variety.

It may be added that miniature buildings may be used with very realistic effect in conjunction with model railways. This is particularly the case in regard to stations and their approaches.

"Mountains, Gold and Cannibals"

By D. I. BOOTH (C. Palmer. 7/6)

We are so used to thinking that travellers in far-off countries must be drawn only from the bravest and the hardiest of men, that it comes something as a surprise to find that this book on mountains, gold, and cannibals is written by a lady. Mrs. Doris Booth always must have been fond of adventure, and from her book it is very evident that she found it in this trip to and through part of New Guinea.

Mrs. Booth arrived in New Guinea in September 1924, and two years later there was a "rush" to a new gold field at Edie Creek. During this rush there was so much sickness that a field hospital had to be established, and here Mrs. Booth rendered valuable service in attending to the sick. We cannot but admire her courage and devotion in the care of the sick—both Europeans and natives—in circumstances such as are seldom met with in these days.

Most of Mrs. Booth's experiences are concerned with the Bulolo Gold Fields, and despite the fact that at the beginning she was told no woman could hope to reach the locality and that the natives were hostile and even cannibalistic, she unhesitatingly went forward and carried out her determination to accompany her husband. Her adventures commenced at the very outset, for when she announced her determination to start for the gold fields, not only did the Government refuse to issue her a "Miner's Right," but they told her that they would place every possible obstacle in the way to prevent her starting out for Bulolo. She managed to stow-away, however, on a small motor schooner on which her husband secured a passage to Salamoa, a small port on the mainland and the entry to the gold fields.

Of the numerous adventures that befell Mrs. Booth and her party we have not space to write. Suffice it to say that the reader of this book will find it of the greatest interest and follow with keen appreciation. As an instance of Mrs. Booth's resource we may mention the occasion on which a native came to her for treatment, fully under the impression that his body was possessed of an evil spirit. He rolled his eyes in apparent agony, and when argument and persuasion had no avail, Mrs. Booth was at a loss to convince him that, to say the least of it, he was suffering from a misapprehension. However, she chanced to remember that when she was serving as a nurse in the Brisbane General Hospital some years before, interesting little chemical experiments had been carried out on occasions. One of these experiments was the production of a magical blue flame by the use of permanganate of potash and glycerine. From the recollection of that old trick she built up a little performance by which she hoped to cure the native. Having obtained the necessary materials from her field medicine chest, she told the sufferer that she could command a good spirit that would eat up the evil spirit within him; that her good spirit was a fine fighter and had never been defeated; and that it was the hero of a hundred battles. The native seemed impressed and a gleam of hope appeared in his eyes.

At this critical moment, unseen by the sufferer, Mrs. Booth poured the glycerine over the permanganate of potash, and performing a few passes with her hands to add effect to the illusion, she told the native that the bad spirit would immediately be driven out of his body. As the glycerine acted on the permanganate there was a hissing sound, and a blue flame floated up towards the roof. With protruding eyes the patient watched the miracle and as soon as his fright had subsided, announced that he was cured. The fame of Mrs. Booth and her "good spirit" immediately spread throughout the district!

Interesting New Books

We hope to deal with the undermentioned books in an early issue.

"AMATEUR CINEMATOGRAPHY" *by* C. Wheeler (Sir Isaac Pitman. 6/-

"ANIMALS IN BLACK-AND-WHITE" Vols. I and II. (Dent. 2/6 each)

"KINGS OF COMMERCE" *by* Bridges & Tiltman (Harrap. 7/6)

"GORILLA: TRACKING AND CAPTURING THE APE-MAN OF AFRICA" *by* B. Burbridge (Harrap. 10/6)

"MARVELS OF MODERN MECHANICS" *by* H. G. WILKINS. (Ernest Benn Ltd. 10/6)

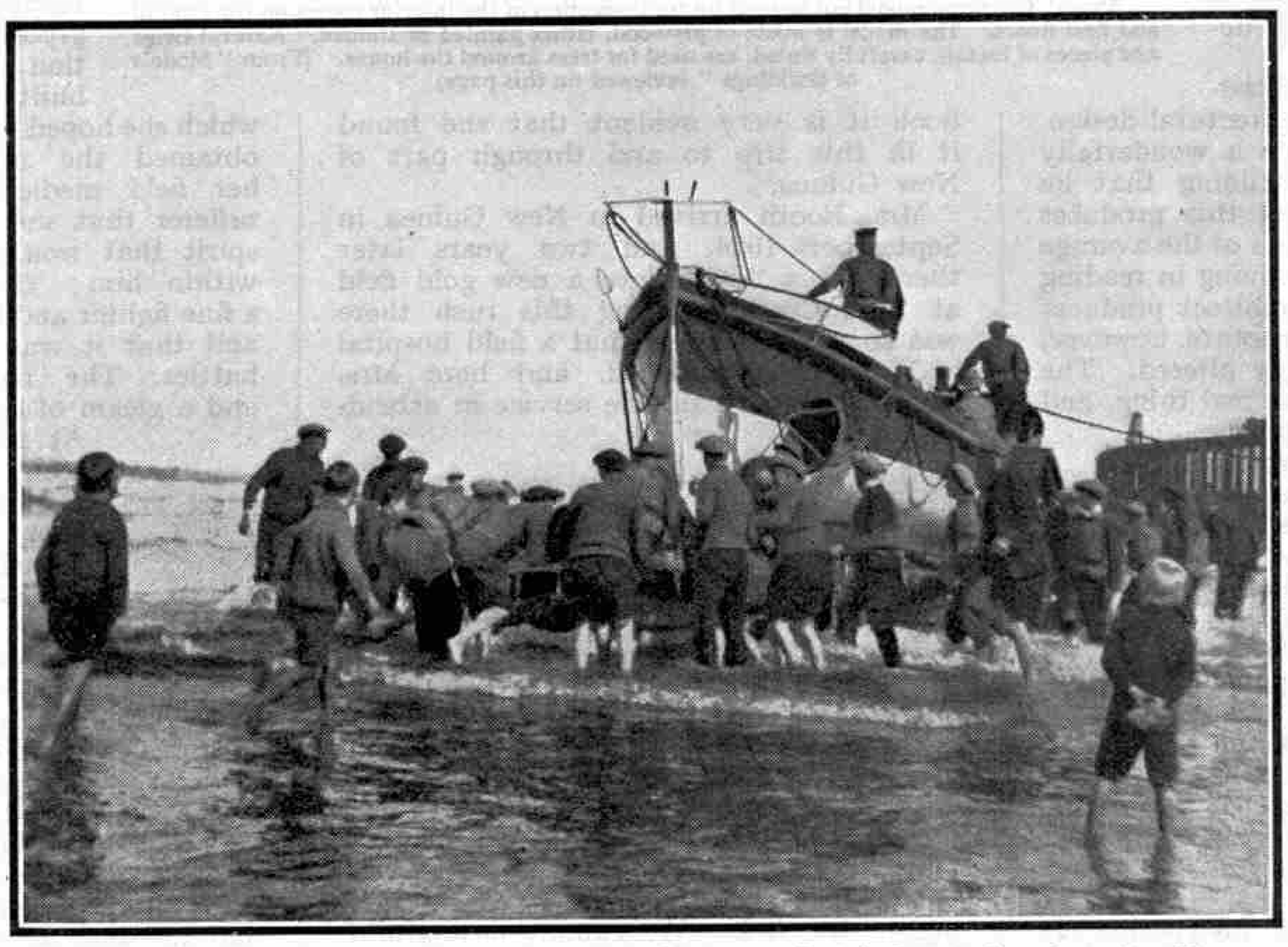
"MOTOR CAR MECHANISM, MANAGEMENT AND OVERHAULING" *by* E. C. M. SHEPHERD (Crosby Lockwood & Son. 2/6)



XII.—DEVELOPMENT OF THE LIFE-BOAT

DURING the 10 years following 1789, when the first boat to be used solely as a life-boat was built, steady progress was made in the establishment of life-boat stations. By the close of 1849 nearly 40 life-boats were in use on various parts of the coast of the British Isles. This progress in large measure followed upon the founding of the Royal National Life-boat Institution in 1824. At first the public showed great enthusiasm in regard to life-boat development, but after a few years their interest waned. Fresh interest was aroused in 1849, however, when the life-boat "*Providence*," while out on rescue work at the mouth of the Tyne, capsized with the loss of 20 of the crew of 24.

In 1851 the fourth Duke of Northumberland became President of the Institution, which from that day has progressed steadily. The Duke at that time was a Rear Admiral, and in the following year he became First Lord of the Admiralty. He brought a new spirit to the work of the Institution, and one of his first acts was to offer a prize of 100 guineas for the best model of an improved life-boat. In announcing the offer the Duke summarised as follows the chief defects of the boats then in use—they were too heavy to be quickly launched; they were not capable of righting themselves when upset; they did not empty themselves of water quickly enough; and, in view of these defects, they were too costly. This offer aroused great interest, and nearly 300 plans and models were received from all parts of the world. A committee of experts undertook the task of examining this huge batch of entries, and in due course they awarded the prize to James Beeching of Great Yarmouth.



Launching a life-boat for a practice trip. A scene that is becoming less familiar as mechanical launching becomes more general

Beeching's life-boat embodied many of Wouldhave's ideas in addition to many valuable improvements. It was the first genuine self-righting life-boat ever built and, except for minor alterations, is the type of self-righting boat in use to-day. The boat had an overall length of 36 ft., a breadth of 9 ft. 6 in., and a depth of 3 ft. 6 in. The seven thwarts were spaced 2 ft. 3 in. apart, and were 1 ft. 6 in. above the floor of the boat. An external belt of cork 6 in. in width and 8 in. in depth was fitted along each side at a distance of 7 in. below the gunwales.

The normal complement of the boat was 30, but in emergency it could accommodate 70 persons. To cope with this load 300 cu. ft. of extra buoyancy was provided by air tanks in the bow and the stern, and arranged along the inner sides except for a distance of 10 ft. amidships. Air chambers were placed between the deck and the floor of the boat. Other features were a false keel half a ton in weight, and a water ballast tank capable of holding 2¼ tons of water and situated amidships. In the floor of the boat were eight 6 in. diameter tubes and four 4 in. tubes, by means of which the boat freed itself from water.

The first life-boat of Beeching's design was purchased by the Harbour Trustees of Ramsgate and gave excellent service.

The Beeching boat was not regarded as perfect, however, and almost every subsequent self-righting life-boat that was built embodied some minor improvement. Although these boats were considered capable of righting themselves when capsized, some of them came to grief in service, and in consequence of these mishaps the R.N.L.I. chief inspector of life-boats recommended in 1884 that the test for life-boats of this type should be made more severe.

Up to that time the practice had been to clear a new boat of all gear, and by means of a rope passed round the boat and attached to a crane, turn the boat upside down in the water. The rope then fell away so that the boat was left to right itself, and if it succeeded in doing so it was certified an efficient self-righting life-boat. This standard test was now revised so that a boat would not be certified as self-righting unless it proved able to right itself when equipped with all gear except sails.

In 1887 the regulations were again revised, and stipulated that a new self-righting boat under test must carry, in addition to gear, a dummy crew in the form of weights of 11 stones each. In addition it was laid down that a sailing life-boat must be able to right itself with all sails set, but "with the fore-sheet not belayed." These conditions have remained in force, and all self-righting boats built at the present time must comply with them before being passed for service.

Self-righting life-boats became very popular, and more than half of the R.N.L.I. fleet to-day consists of boats of this type. The number is decreasing yearly, however, for experience has shown that although these boats can right themselves when they capsize, they are more liable to upset in a heavy sea than are vessels of the non-righting type.

The ability of the self-righting life-boat to resume automatically its normal position immediately after capsizing is due mainly to spacious air chambers known as "end-boxes" installed in the bow and the stern; and to a less extent to the heavy keel, which sometimes accounts for no less than one-fifth of the total weight of the boat. The elevated position of the end-boxes exposes them to the buffeting of wind and sea, thus rendering the boat more difficult

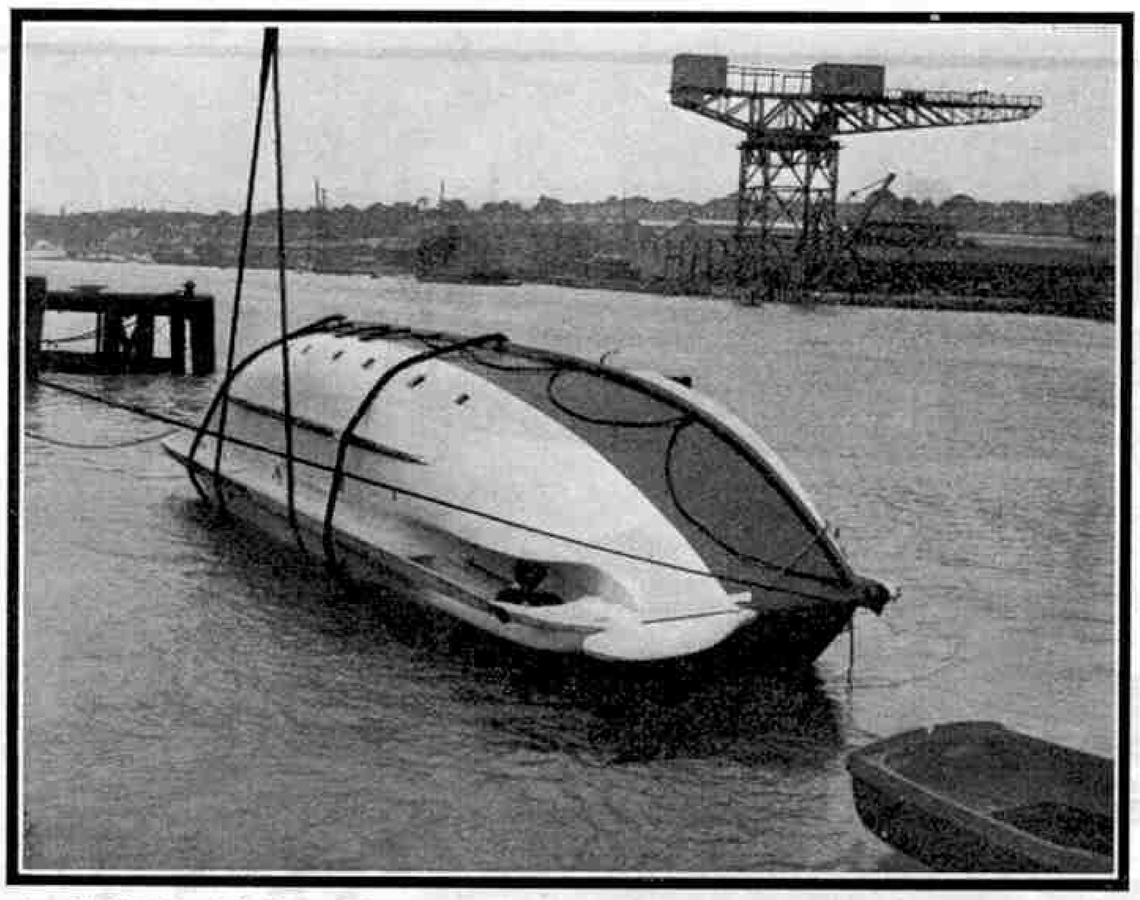
to navigate. In consequence it has become recognised that, in regard to life-boats that have to go well out to sea in the performance of their duty, it is preferable to sacrifice the self-righting feature in favour of a non-righting boat that will be more stable.

Life-boats that are equipped only with oars are termed "pulling" boats; those provided only with sails are known as "sailing" craft; while boats that carry both oars and sails are known as "pulling and sailing" vessels. There are several types of pulling and sailing life-boats in use to-day that are not self-righting, and of these the most important is the "Watson" type. In 1890 the R.N.L.I. requested Mr. G. L. Watson, their consulting naval architect, to design two new life-boats, one of the pulling and the other of the sailing class. These boats were duly completed and were the forerunners of the standard "Watson" type of life-boat that is built at the present time. The sailing life-boat cost £1,564, and was 43 ft. in length by 12 ft. 8 in. in width amidships, at which point it was 6 ft. in depth. It was equipped with a cork gunwale 15 ft. 6 in. in length, and 16 relieving tubes for the egress of water were provided in the bottom of the boat. The pulling boat was smaller, being only 38 ft. in length and 9 ft. 4 in. in width.

An event of even greater importance that occurred in the same year as the introduction of the "Watson" boat was the completion of the first steam life-boat. This was named "*Duke of Northumberland*," and was 50 ft. in length and 15 ft. in width. Although it was not a self-righting boat it was constructed on the same principle, a modified form of end-box or air chamber being fitted in the bow and the stern. The most notable feature of the boat was the method of propulsion. In consequence of the difficulty of protecting the propeller from injury as the result of contact with wreckage or sand-banks, this means of driving the boat was abandoned in favour of hydraulic propulsion. The "*Duke of Northumberland*" was equipped with a powerful pump driven by two horizontal engines, which drew in water through an opening in the bottom of the boat and discharged it through apertures in the sides. The pump was capable of driving the boat at a speed of nine knots, and when working at full pressure drew up one ton of water per second.

After serving at Harwich for two years this life-boat was transferred to Holyhead and later to New Brighton, from where it was returned to Holyhead in 1897. It is recorded that King Edward VII, then Prince of Wales, accompanied by the then German Emperor, travelled on board the life-boat on her voyage from Cowes round the coast. The "*Duke of Northumberland*" was in active service until 1922.

A second steam life-boat was constructed for Harwich in June, 1893, to replace the "*Duke of Northumberland.*" This boat was designed by the R.N.L.I. consulting naval architect and was named "*City of Glasgow.*" It was 52 ft. in length by 15 ft. beam, and was equipped with two vertical engines. Under service conditions it was found that these engines did not function as well as the horizontal engines installed in the earlier boat, and when a third steam life-boat was built in 1897 the original type of engine was reverted to.



A self-righting life-boat being overturned during test. The photograph shows clearly the design of the under-water portion of the boat. Note how the screw propeller is placed in a special recess to protect it from injury by contact with wreckage or sand-banks. For the photographs on this and the following page we are indebted to the Royal National Life-boat Institution

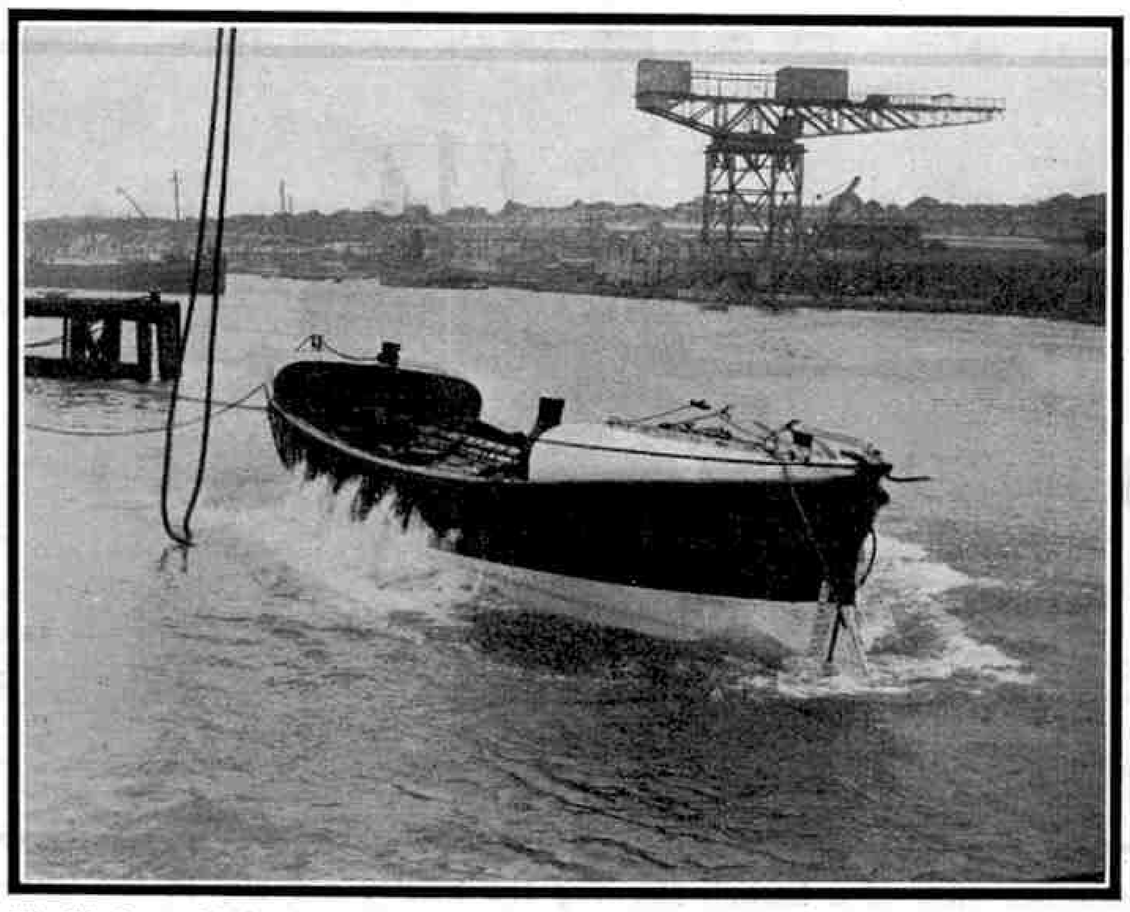
The hydraulic system of propulsion did not prove as efficient as had been hoped, and eventually the R.N.L.I. decided to equip future steam boats with screw propellers. The problem of protecting the propeller against injury again arose, and in the first boats the propeller was fitted in a recess at the rear of and beneath the cockpit. This recess is still a feature of screw life-boats.

The first steam life-boats to be equipped with screw propulsion were the "*James Stevens*" Nos. 3 and 4, built in 1898. These boats were 63 ft. in length by 18 ft. 8 in. in width. No. 3 boat was stationed at Grimsby and No. 4 at Padstow.

It was about this time that the internal combustion engine began to attract serious attention, and when the practicability of this source of power was recognised the R.N.L.I. began to consider how best it could be adapted for use in life-boats. There were many difficulties to overcome, however, in designing an engine of this type that would comply with the strict requirements of the life-boat service. For instance, such an engine must be watertight but not airtight, and be capable of running and lubricating itself efficiently when canted to any angle by the movement of the boat in a heavy sea. It must have controls easy to distinguish by touch and simple to manipulate, so that they could be operated in the dark without any risk of mistakes being made; and although so equipped the engine must be capable of running unattended under all adverse conditions. Also, it must be provided with an automatic cut-off that would operate immediately the boat was on the point of capsizing. Without such provision a life-boat capable of righting herself after capsizing would speed away before the crew could scramble aboard and regain control of the vessel.

Experiments were commenced early in 1904, at Cowes, where a 12 b.h.p. two-cycle motor was installed in a 38 ft. self-righting life-boat that was sent to Tynemouth. The boat was tested before despatch and attained a speed of six knots with the motor running at 450 r.p.m., while the petrol consumption averaged 1½ gals. per hour.

Subsequently trials were carried out with other life-boats in which motors of increased power were fitted, and the results obtained were so satisfactory that the Institution decided to instal a motor in a new self-righting life-boat to be built for Stromness. The propeller was accommodated in a special tunnel-shaped recess in the hull and could be reached from the inside of the boat by way of a water-tight hatchway, the entrance to which was situated in front of the aft end-boxes. By means of this hatchway the propeller could be cleared of any obstructions, such as seaweed or tangled ropes, while the boat was afloat. At her trials in 1909 the life-boat was found very satisfactory and later was despatched from the Thames to Stromness, accomplishing the journey under her own power.



The life-boat righting itself immediately after being freed from the rope. The manner in which the boat empties itself of water is clearly shown

This and other motor life-boats constructed during the ensuing 18 years were equipped with oars, and some also with sails, the motors being used only when weather conditions made it difficult or impossible to propel the boat with oars or sails.

Many instances could be given of successful rescues carried out by motor life-boats under conditions that proved too difficult for boats dependent upon oars and sails, but one will suffice. The

hospital ship "*Rohilla*," of 7,400 tons displacement and carrying 229 persons, was driven ashore on Saltwick Nab, near Whitby, in a terrific storm that raged during the early hours of 30th October, 1914. Great waves crashed against the ship, which soon broke in half, many of the unfortunate people on the after portion being swept into the sea and drowned.

At daybreak the Whitby No. 2 life-boat was called out. The task of launching the boat involved lifting it over a sea wall 8 ft. in height, and during this difficult task the boat was badly damaged. In spite of this it was launched and succeeded in reaching the "*Rohilla*," 12 men and five women being rescued and brought ashore. The life-boat made a second journey and after a terrific struggle again reached the wreck, which lay surrounded by a mass of rocks. The heavy seas repeatedly broke over the boat but the crew courageously stuck to their task and succeeded in rescuing 18 more persons.

By this time the life-boat was totally unfitted for further service, and other life-boats were called out. Among these was the Upgang boat, which was lowered down the almost vertical cliff by means of ropes. It was some time before this boat could be launched against the heavy surf pounding on the shore, and when it finally got away it did not succeed in reaching the wreck, although repeated efforts were made until the crew were completely exhausted.



Launching a life-boat by means of a caterpillar tractor. This form of haulage has been found excellent where the boat has to be hauled across waterlogged sandy beaches. In the above photograph the depth to which the rear wheel of the boat carriage is sunk gives some idea of the difficulties involved

It was realised that more drastic steps would have to be taken to rescue the remainder of the passengers and crew of the "*Rohilla*." Whitby No. 1 and the Scarborough life-boat were then launched and, towed by trawlers, endeavoured to reach the wreck, but eventually both had to retire defeated. The Teesmouth boat also was unsuccessful and was slightly damaged in the attempt. It was clear by this time that only a motor life-boat had any chance of reaching the "*Rohilla*," but the nearest boat of this type was stationed at Tynemouth, nearly 50 miles away. The situation was so desperate, however, that the boat, the "*Henry Vernon*," was summoned, and in less than 15 minutes after receiving the call it was manned and under way. After a perilous trip, the hazards of which were greatly increased by the fact that on account of the War all coast lights were extinguished, the "*Henry Vernon*" reached Whitby early on the following morning. A supply of oil was then taken on board for use in subduing the waves in the vicinity of the wreck, and the boat then set out to the rescue. On arriving close to the ship oil was discharged, and the life-boat was then skilfully guided under the lee of the vessel and remained alongside until all on board were transferred safely. Ultimately the "*Henry Vernon*" arrived safely at Whitby and received a warm welcome from the crowd of spectators who had anxiously watched the heroic efforts of the crew.



Another view of a launch showing the tractor actually in the water

The first motor life-boat to be wholly dependent upon her engines was designed by Mr. J. R. Barnett, who succeeded Mr. Watson as the R.N.L.I. consulting naval architect. This boat was completed in 1923, and formed the first of what is now known as the "Barnett" type of boat. It is 60 ft. in length and 15 ft. in breadth, and has a draught of 4 ft. 6 in. It is constructed of a double thickness of teak and has 15 main water-tight compartments formed by transverse and longitudinal steel bulkheads. Although not a self-righting vessel it has been made as nearly unsinkable as possible, and its equipment includes 100 air cases distributed in numerous compartments. Sufficient relieving valves are provided to enable the boat to empty itself of water as fast as the sea can pour it in.

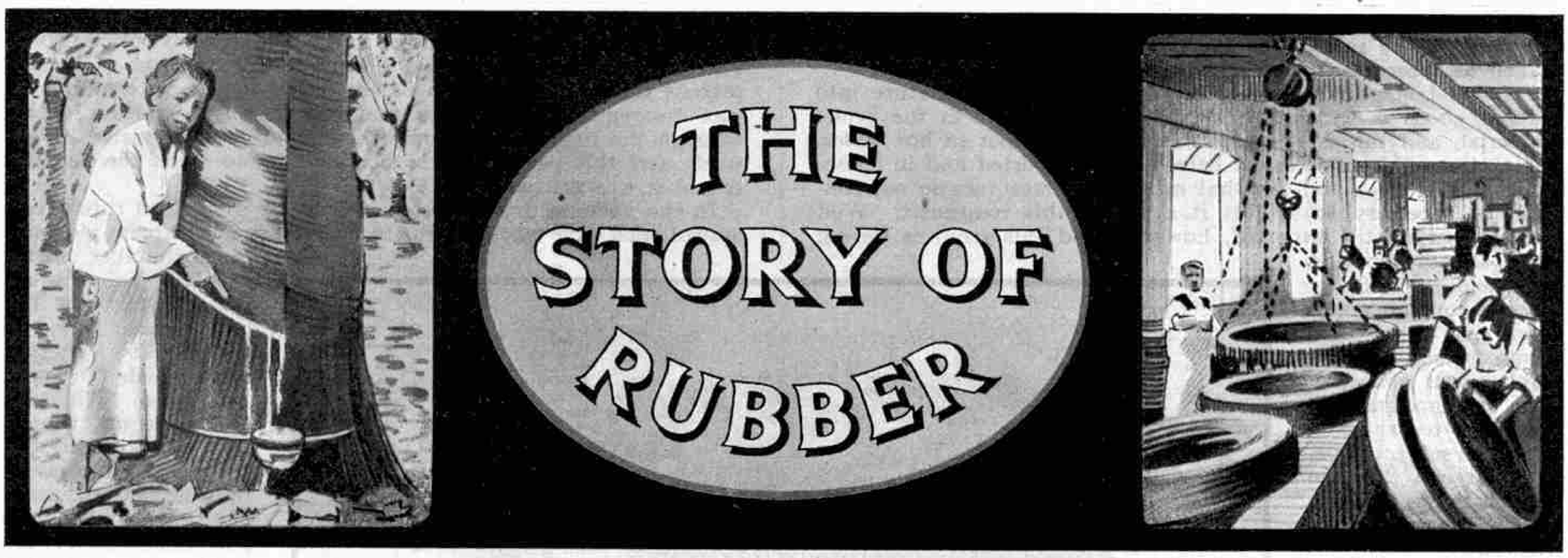
Two 80 b.h.p. six-cylinder petrol motors are installed in separate water-tight compartments, so that if one of them should be flooded and rendered useless the other may continue running. Sufficient petrol can be carried for a journey of 150 miles at cruising speed, and this is stored in three compartments immediately behind the engine room. The two propellers are situated in tunnels separated by the keel.

This life-boat is the first to be fitted with cabins. There are two of these, each providing accommodation for about 50 people, although when rescue conditions demand about 150 persons can safely be taken on board.

The rescue equipment of the boat includes a line-throwing gun with a range of 80 yds., by means of which a line can be thrown over a wreck. A net is stretched over the deck, at a sufficient height to avoid interfering with the work on the boat, and into this net people can jump when the life-boat is alongside a wreck. Equipment is provided for throwing oil on rough seas, and a powerful search-light is installed on deck.

Motor life-boats can cover distances that are impossible for boats dependent upon oars and sails, while their greater power enables them to force their way forward in the face of winds and seas before which other types of boat would be helpless. Another great advantage of the motor life-boat is that it can be manœuvred more swiftly and effectively than either the pulling or the sailing type.

A modern life-boat costs from £4,500 to £14,500 and an almost equal amount has to be expended in providing a boat-house and a launching way. In addition £1,000 or more is expended yearly in maintaining the life-boat and its permanent crew. Each new development of mechanical power adds to the efficiency of the life-boat service, but at the same time increases its cost, and the total expenditure of the Royal National Life-boat Institution has gradually increased until no less than £250,000 is required each year to maintain the service efficiently. The raising of this huge sum annually is a big task, for the Institution receives no State subsidy of any kind and depends entirely on voluntary contributions.



III.—FROM LATEX TO VULCANISED SHEET

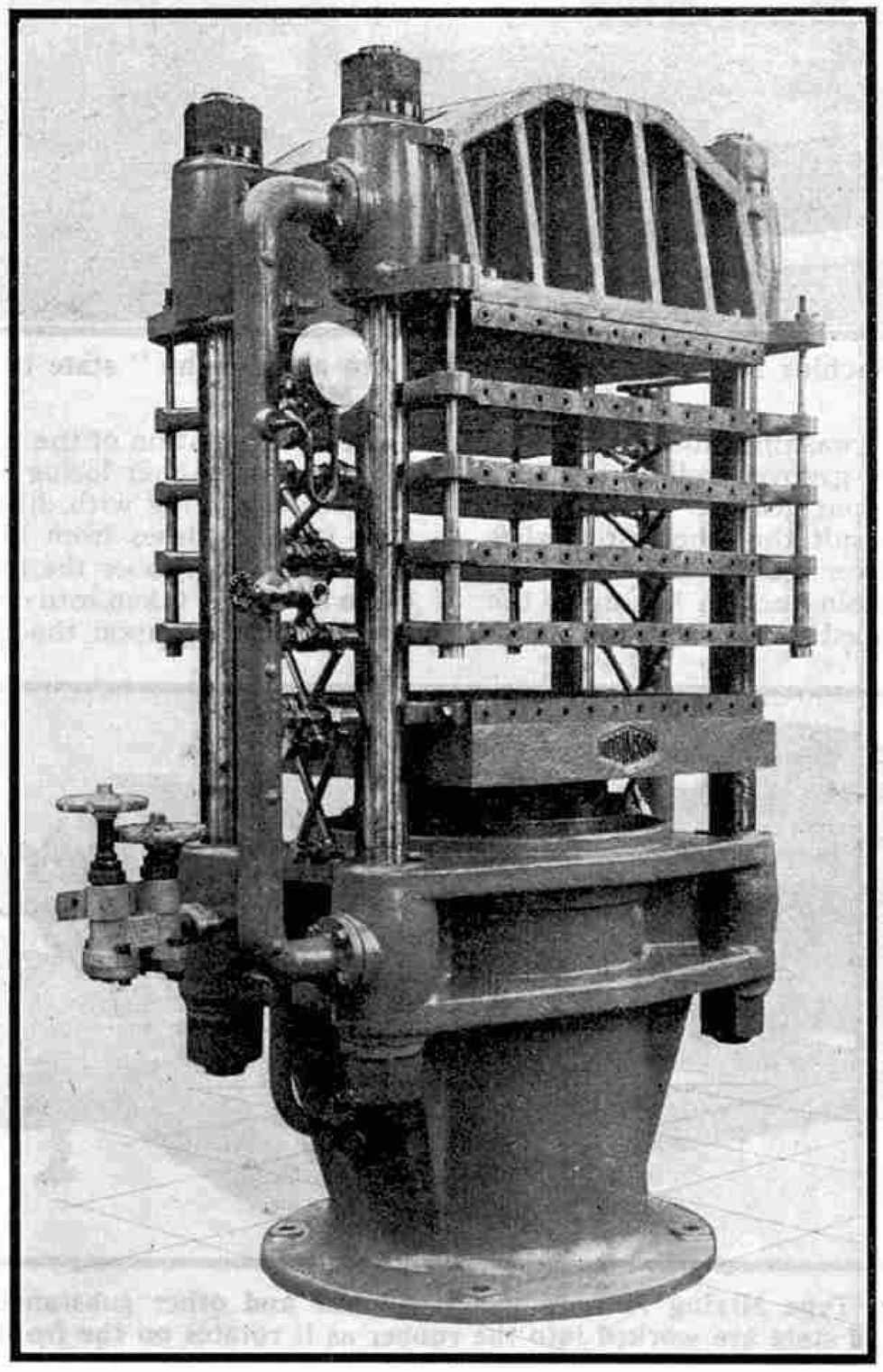
THE latex that is collected from the rubber trees in the manner described last month would deteriorate rapidly if left in its natural state, and it is essential to preserve it within a few hours of the time it is obtained. In the case of rubber exported in liquid form it is necessary to add to the latex some ingredient that will prevent it from coagulating, and ammonia is generally used for this purpose. The liquid is then poured into small containers, or if required in large quantities it is conveyed by rail or road tank wagons to the nearest port, where it is transferred into the tanks of ships. The greatest care has to be exercised in transporting the treated latex. It is a very delicate substance and it loses quality rapidly if it is in any way badly handled, or if the ammonia is allowed to evaporate.

The greater proportion of plantation rubber is exported in the form of ribbed smoke sheet or as crêpe. To produce the former the latex received at the factory is poured into large tanks, from which it is passed through a fine mesh sieve into shallow tanks lined with tiles, hard wood or aluminium. Water is then added in the proportion of from one to two parts to each part of latex. A small quantity of dilute acetic or formic acid is next added and the mixture is well stirred. The object of the acid is to coagulate the latex, but before this action commences a series of partitions are placed across the tanks. These partitions are spaced about 2 in. apart and they divide the latex in the tanks into a series of sheets. In this condition the latex is left overnight, and in the morning the partitions are lifted out and the coagulated latex is removed in the form of white sheets still containing an appreciable amount of moisture.

The next process consists of passing the sheets through a series of rolling machines that squeeze out the moisture and reduce the thickness of the sheets to about $\frac{1}{8}$ in. The machines are usually grouped in fours, each one having a closer "nip" than the previous one; while the last machine has rollers that give the sheet the familiar diamond-shaped markings. Although the object of the rollers is to get rid of the moisture, a constant spray of water is directed on to them in order to wash away the impurities extruded from the sheets.

The rolling machines are small and so light that they may be operated by hand or treadle power. In some modern plantation factories, however, a 6 h.p. engine is used to drive each battery of machines. The output of one group of four machines varies within the limits of 300 to 450 lb. of rubber per hour.

The sheets of rubber are now of a milky-white colour and are washed to remove all traces of impurities. They are then allowed to drip for a short time in the sun and afterward removed to the smokehouse, in which fires are lit and maintained in a smouldering state so as to produce abundant smoke without flame. The sheets are hung on elevated racks, where they are exposed to the fumes of the smoke and to a moderate temperature. The process which improves the quality of the rubber, takes from six to fifteen days, according to the type of smokehouse that is employed. When the treatment is completed the sheets are of a dark amber colour, absolutely dry, and ready for export. They are removed from the racks and sent to the packing shed where they are trimmed to shape and packed ordinarily in square boxes, each holding about 2 cwt. of rubber. At some plantations the sheets are packed in the form of 2 cwt. bales that are well wrapped and secured by iron strapping.



Vertical type of press for vulcanising rubber. When the rubber has been placed on the various shelves they are brought together by hydraulic power. For this and the other photographs illustrating this article we are indebted to J. Robinson & Co. Ltd., Manchester

The manufacture of crêpe rubber is quite a different process. The latex that has been collected from the cups is coagulated in the manner already described, except that it is not divided into sheets. When the latex has coagulated it is transferred to the crêping plant. This usually consists of batteries of seven rolling machines driven by an engine of about 75 h.p., each machine having two rollers that are either smooth or fluted. The rollers of each pair rotate at a different speed, and this difference produces the tearing action that gives the crêpe rubber the uneven surface from which it derives its name. The difference in speed, combined with the weight and close set of the rollers, results in the extrusion of considerably more moisture than takes place in the making of sheet rubber, while a much thinner rubber also is obtained. After passing through the machines the long strips of crêpe, about 9 in. in width, are hung up in a drying shed, which is usually artificially ventilated and warmed. When dry they are removed and packed in the same manner as ribbed smoked sheet.

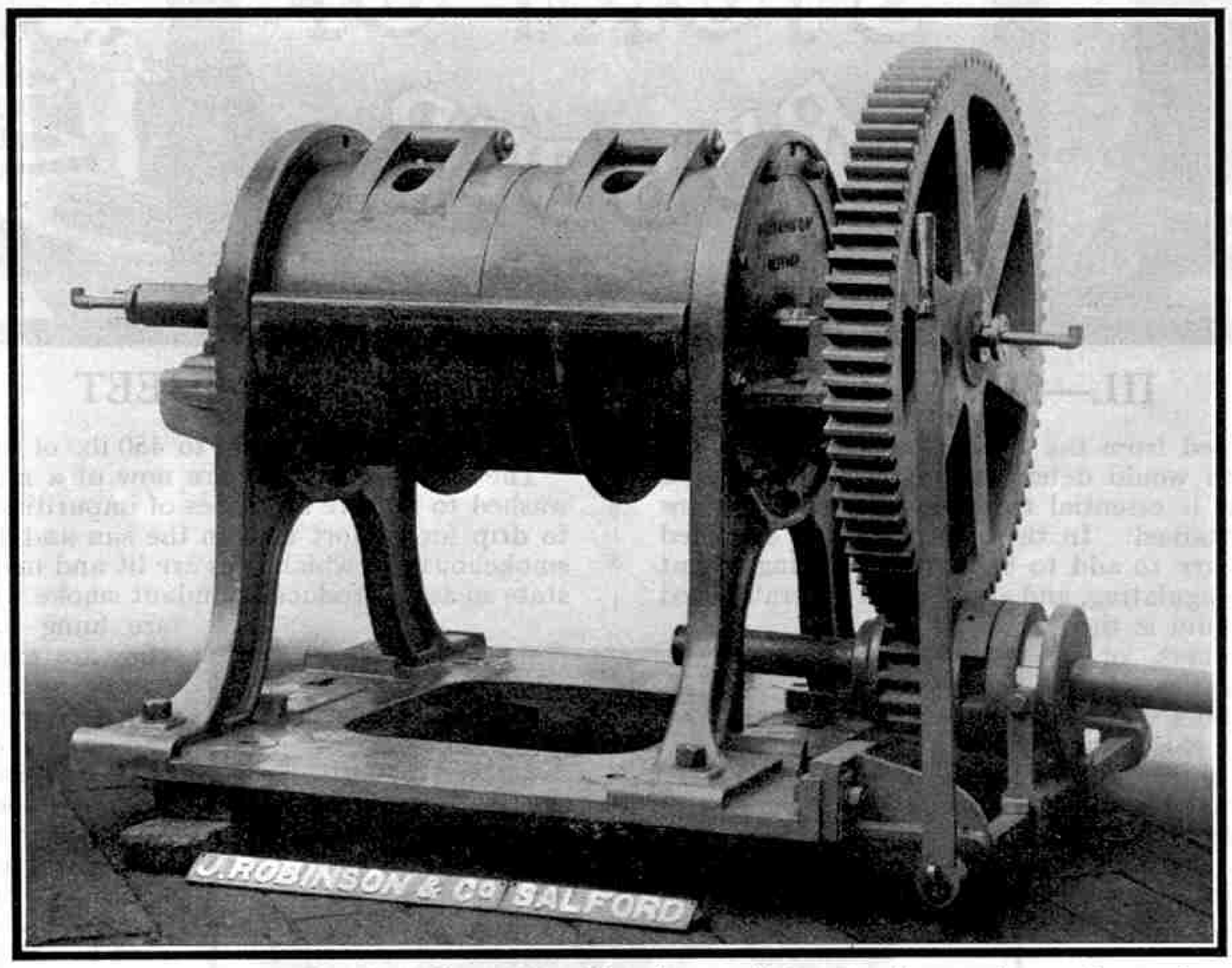
The preparation of "sole crêpe" is a further refinement of the crêping method. In this process numbers of layers of the finest crêpe are rolled under great pressure into a solid mass.

In this country the principal ports to which raw rubber is shipped are London and Liverpool. On arrival the rubber is stored in vaults, and samples are taken from the consignment. The rubber

is then sold by private treaty, the quality of the samples being taken as representative of the whole consignment.

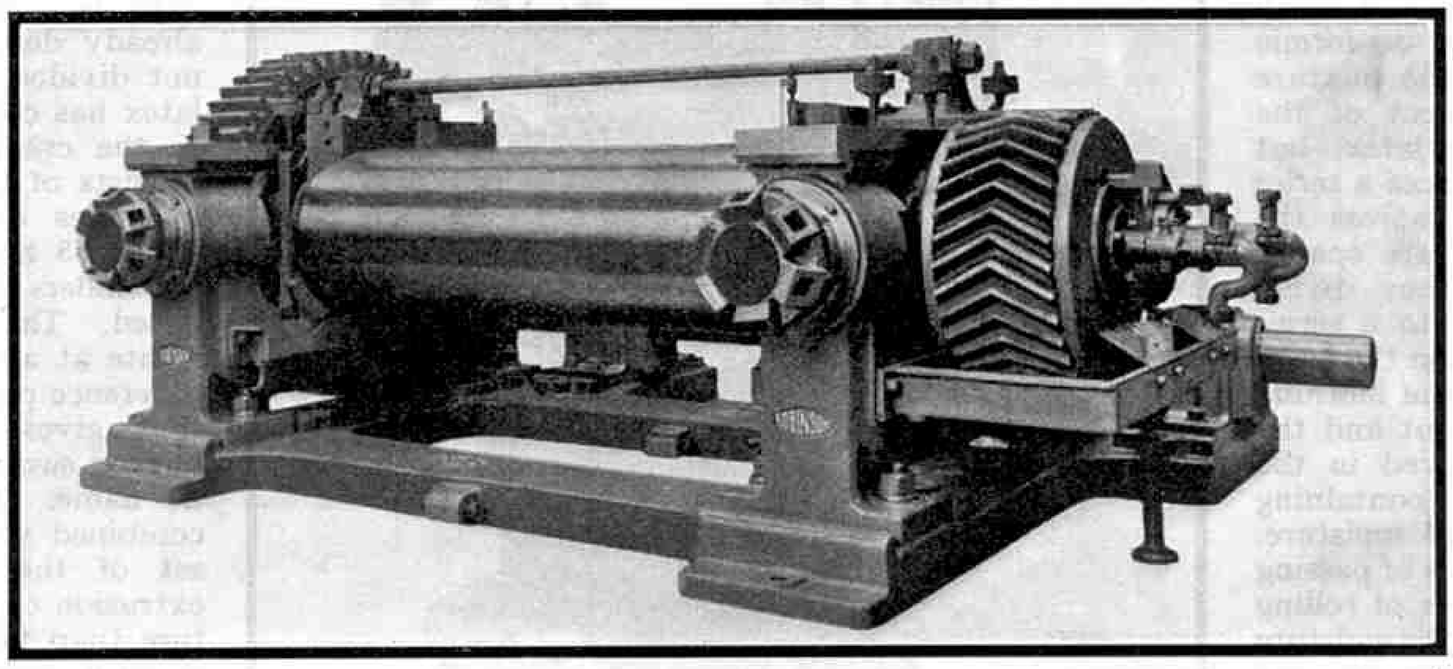
The first step in preparing raw rubber for manufacture into rubber goods is to remove all impurities present in the crude material, and this is done by washing the rubber in hot water. Plantation rubber is washed before being exported and in consequence is so clean and dry that many manufacturers do not consider it necessary to subject it again to this treatment. Wild raw rubber is still imported, however, and this requires freeing from all moisture and dirt before it is fit for use. In consequence of the time that has elapsed since the wild rubber was collected, and the handling and exposure to which it has been subjected before arrival at the factory in this country, it is washed more rigorously than is plantation rubber.

If the wild rubber has been purchased in the form of large lumps, these are cut into smaller pieces by hand or by a hydraulic cutting machine, and are thrown into a tank containing water kept hot by means of a steam-filled pipe. In the tank the lumps of rubber soften gradually and swell, at the same time absorbing moisture. The period of their immersion depends upon the grade of the rubber, but the pieces are removed immediately they have become sufficiently soft to be dealt with effectively in the washing mill. This is a vertical machine containing two deeply grooved rollers that are driven from a main shaft by means of spur gearing. Each roller rotates at a different speed, with the result that the faster roller draws the rubber forward while the slower roller tends to hold it back. The tearing effect that this opposing action has upon the rubber is helped by the diamond-shaped or spiral grooves of the rollers.



Masticating Machine for kneading the rubber into a "doughy" state in readiness for treatment in the Mixer

The operator passes the raw rubber several times through the machine, on each occasion subjecting the material to greater pressure by manipulating two adjusting screws that draw the rollers closer together. Under this increasing pressure the lumps of rubber, torn apart in the manner just mentioned, are merged into an irregular-shaped mass, from which fragments of bark, small stones and dirt are forced out. These impurities are swept away by a flow of water that is directed continuously upon the rubber.



Two-roll Open Type Mixing Mill, in which sulphur and other substances in a finely powdered state are worked into the rubber as it rotates on the front roller

As may be imagined, the softening and cleansing of raw rubber is a sloppy business, and the workmen engaged in this work wear rubber boots and aprons. When washing is complete the rough sheet of rubber is passed through a similar machine equipped with smooth rollers that press the rubber into an even sheet 1/16th in. or $\frac{1}{8}$ in. in thickness. This sheet may be as much as 15 ft. in length, and is approximately 2 ft. in width. In the company of other similar sheets it is transported on a low truck or a mechanical conveyor to the drying room.

In the early days of the rubber industry the sheets of raw rubber were suspended in a room and allowed to dry at leisure, a natural process that took from two to six weeks to complete. Later it was discovered that by mechanically passing a current of air through the room continuously the rubber could be dried in one week, and this period was reduced still more when the vacuum chamber was introduced.

In the vacuum drying system the sheets of washed rubber are spread upon large trays, which are then inserted in a steam-jacketed metal chamber. Steam from the jacket is distributed to pipes beneath each tray, or into hollow shelves upon which the trays are placed. When all the trays are loaded and in position the swing doors are closed, thus hermetically sealing the chamber. A powerful exhaust pump is then started and this draws off the air and the moisture. By means of an observation glass the operator is able to watch the progress of the drying. At the commencement of the operation the water can be seen pouring rapidly off the rubber, but as drying continues the quantity of water and the rate of evaporation decrease, while the temperature rises. By this method the rubber is dried in from two to three hours, during which time the temperature increases to about 100°F.

The elimination of the various impurities and of all water results in the raw rubber losing considerable weight, the amount of this decrease varying with different grades. Standard fine hard Para, for instance, loses from 15 to 20 per cent. of its weight, while with Cameta wild rubber the loss is between 40 and 50 per cent. This loss has to be taken into consideration, of course, by manufacturers when deciding upon the quantity of the raw material they must purchase to meet their requirements.

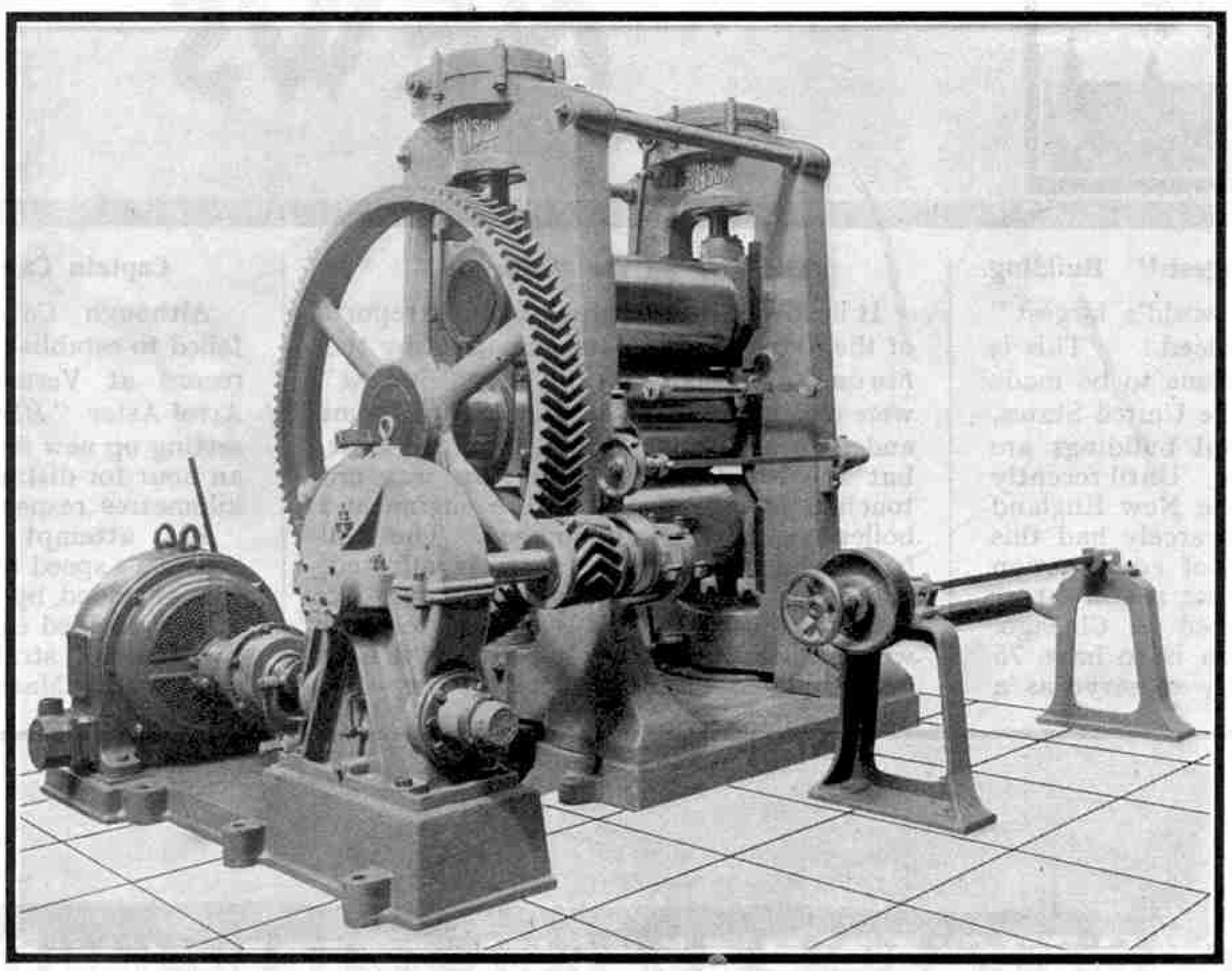
From this point onward the wild rubber and the plantation rubber undergo the same treatment.

The washed and dried rubber, whether of the wild or the plantation kind, is useless to the manufacturer until it has been vulcanised. The vulcanising process consists of combining the rubber with finely powdered sulphur, by means of heat, and it gives to the rubber strength and elasticity, at the same time causing it to become unaffected by even considerable changes of temperature. Rubber to which sulphur only is added forms the purest vulcanised rubber, but this high grade material is not suitable for all commercial purposes. By adding various other minerals in powdered form during the vulcanising process, the quality, elasticity and toughness of the rubber may be altered to suit special requirements. These additional ingredients are termed "compounds" and they include zinc oxide and litharge (an oxide of lead), both of which have a toughening effect upon the rubber, while the litharge also speeds up vulcanisation. Rubber goods are produced nowadays by

adding certain compounds to the rubber and sulphur during mixing. The familiar red rubber, for instance, is obtained by the addition of antimony sulphide or the cheaper compound oxide of iron.

The various compounds required for a particular mixing are selected by the factory laboratory staff. When the required quantity of a compound has been prepared it is poured into a small container, and as the powder falls it passes through a fine sieve that sifts it of all foreign matter. When all the compounds required have been dealt with, the loaded containers are transported on a mechanical conveyor to the mixing mill for association with the rubber.

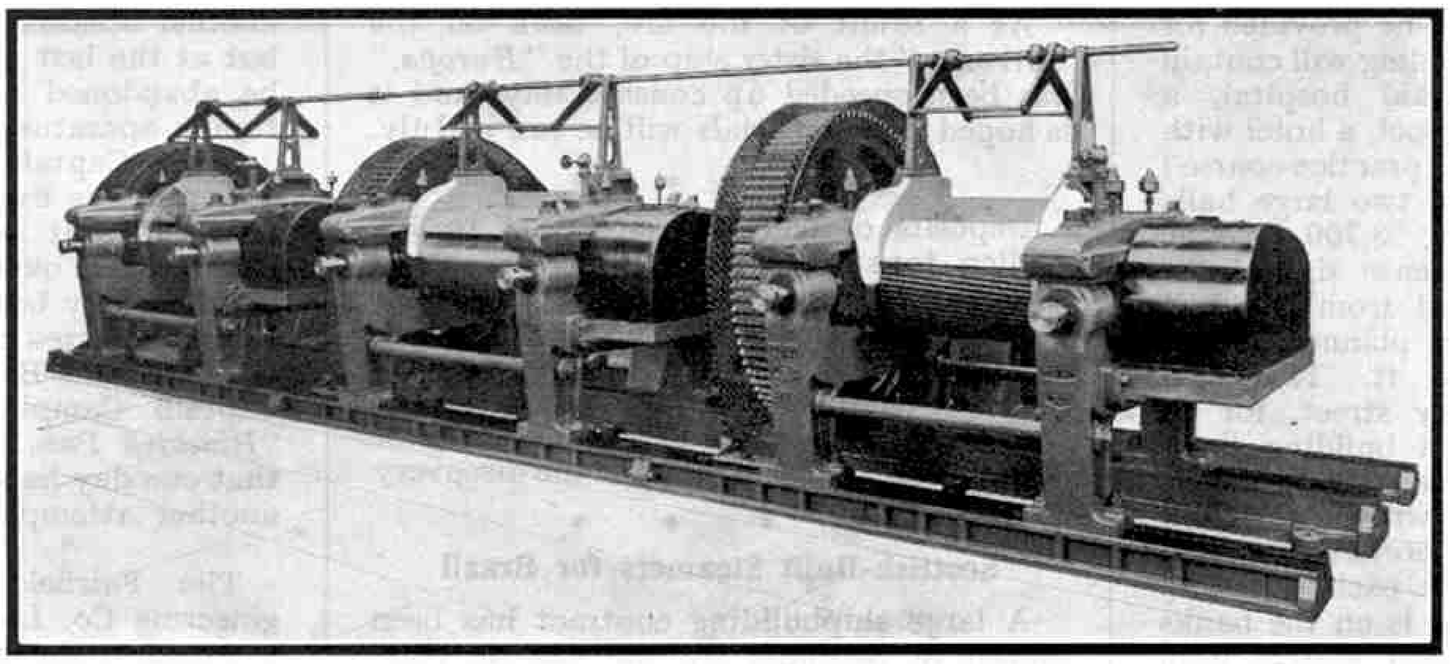
Before the rubber is fed to the mixing mill it is passed through a machine called a "masticator," which works it up until it is again in a doughy condition. The masticator is similar in appearance to the washing machine and has two smooth steel rollers one behind the other, and geared so that each rotates at a different speed. The rollers are hollow and are constructed so that either steam or cold water may be passed through them without touching the rubber. By this means the operator is able to heat or cool the rubber according to its condition or to the temperature of the room. It is very important that the rollers should not be allowed to become overheated for then the rubber would adhere to them.



Three-roll Calendering Machine in which the rubber is drawn out in the form of a thin sheet that is then transferred to the vulcanising press

As the result of experience the operator is able to judge by hand when the rollers have attained the correct temperature, which varies with different grades of rubber. He feeds the rough sheet over the foremost and slower moving roller around which it soon becomes coiled to a sufficient thickness to come in contact with the rear and faster moving roller, which then begins to masticate it. The rear roller rotates in a fixed position, while the one carrying the rubber may be made to travel backwards and forward over a limited distance by the operation of two adjusting screws at the front of the machine. The operator is thus able to regulate the pressure exercised by the rear roller.

When the rubber is sufficiently masticated it is removed to another and similar machine for the mixing process. It is fed to the front roller and when it has become wrapped around this the operator manipulates the adjusting screws until the rollers are drawn sufficiently close to each other to cause the plastic rubber to form a trough between them as they rotate.



A batch of rubber-washing machines. In the machine on the right can be seen the fluted roller that by tearing open the rubber assists materially in extruding foreign substances

The operator now takes up the sulphur and dusts it over the rubber-covered roller, where it is gradually absorbed. Some sulphur falls between the rollers and this is caught in a tray that is subsequently tipped on to the rubber so that none of the sulphur is lost. The other materials required are then added to the rubber in a similar manner, care being taken that each is fully absorbed.

The various compounds are now mixed with the rubber but they are not evenly distributed; and to effect this the operator slits the rubber as it rotates in front of him and folds back the loosened piece across the roller. This process is repeated several times, first at one side of the rotating roller and then at the other, until the compounds have become quite evenly distributed. The rollers are then drawn very close together and the increased pressure effectively crushes any lumps of mineral that may exist. The thick rough-shaped mass of rubber is then cut across and drawn off the machine and conveyed to still another roller machine in which it undergoes final treatment before vulcanisation.

At some large rubber factories the two-roll open mixing mill just described has been superseded by a machine known as the Bridge-Banbury patent automatic rubber mixing machine. This machine, which can also be used as a masticator, is made in sizes ranging from 65 lb. to 600 lb. capacity, and the largest size can accept entire undivided bales of rubber, cut them up and masticate the rubber! At a later stage the rubber is returned to the machine for the mixing process.

In the Bridge-Banbury mixer the rubber and compounds are fed into a hopper at the top of the machine and pass down into an enclosed trough in which are powerful blades that rotate and thoroughly mix the materials. The walls of the machine and the mixing blades are hollow for heating and cooling purposes. The rubber is introduced first, and when this has been thoroughly broken up by the rotating blades the compounds are added. A special timing device is then set to indicate by sight or sound, or both, when the machine has turned the number of revolutions necessary for that particular mixing. As the mixing proceeds the operator is able to observe the temperature of the rubber by means of a specially constructed thermometer so built into the machine that the sensitive end of the instrument is inside the mixing chamber. When the material is thoroughly mixed he manipulates a small valve that opens a door in the base of the trough, and the mixture is discharged into a truck or passed down to a pair of rolls from which it emerges in the form of a long sheet. A special knife may be inserted in one of the rollers and set so that it will automatically cut off the sheet of rubber in any desired lengths.

Rubber mixture that is not drawn out into sheet at the mixer is conveyed to a massive three-roller machine known as a "calender." In this machine the rubber is fed between the two upper cast-iron rollers, which compress it into a thin sheet, and in this form it passes round the middle roller and between this and the bottom cast-iron roller. At the same time that the rubber is introduced into the machine a length of calico or other fabric carried on a wooden roller at the front

(*Continued on page 495*)



ENGINEERING NEWS

Another "World's Largest" Building

Construction of the "world's largest" building has been commenced! This is an announcement that seems to be made with great regularity in the United States, where large and wonderful buildings are erected in rapid succession. Until recently the record was held by the New England Building in Boston, but scarcely had this passed the initial stages of construction when it was announced that a still larger building was to be erected in Chicago.

The new building, which is to have 75 storeys, is intended mainly to serve as a market for clothing and apparel manufacturers. Many of the thousands of people who will work in it will arrive every morning in motor cars, and a garage capable of accommodating 1,024 cars will form part of the building. Transport will be provided for by 68 elevators. The building will contain also two clubs, a first-aid hospital, a gymnasium, a swimming pool, a hotel with 440 rooms, and even a golf practice course! In addition there will be two large halls each capable of seating 3,700 people.

Some idea of the immense size of the building may be obtained from the fact that a street or arcade is planned to run through the middle of it. This will resemble an ordinary city street, for on each side of it will be a building three storeys in height. Above it, however, instead of the sky there will be the floor of the first of the 72 storeys rising from the level of the shops on each side.

The site of the building is on the banks of the Chicago River, and vessels from the Great Lakes will be able to steam into the river and discharge their cargo in front of the building. In addition, there will be a complete railway station situated underground. Below the ground there will be three storeys, the lowest of which will contain the machinery necessary for supplying the whole building with light, heat and power.

It will be seen that this building is practically self-contained, and thus it may almost be described as a miniature city. This is an interesting feature of most of the large buildings now being built in America.

The Fire on the "*Europa*"

It is now quite clear that the first reports of the extent of the damage caused by the fire on the German Atlantic liner "*Europa*" were exaggerated. The large public rooms and cabins amidship were burnt out, but the after part of the ship was untouched by the fire, and the engine and boiler rooms were undamaged. The hull below the main deck is scarcely affected, and the vessel is quite seaworthy. Restoration work is being pushed forward with all speed, and it is hoped that it may be completed before the end of the year.



Heavy work on the shores of the Baltic Sea. Hauling ashore the southern end of the telephone cable between Germany and Sweden

As a result of the fire, work on the "*Bremen*," the sister ship of the "*Europa*," has been speeded up considerably, and it is hoped that her trials will be run in July.

* * * *

Deposits of bauxite amounting to 180 million tons have been discovered about 45 miles to the west of Kumasi on the Gold Coast. Bauxite is a valuable ore of aluminium and as there is some prospect of the development of water power locally, the world's supply of aluminium may be largely increased as a result of the discovery.

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Scottish-Built Steamers for Brazil

A large shipbuilding contract has been placed in Scotland by the Cia de Nav. Lloyd Brasileiro of Rio de Janeiro. Under it no fewer than 18 vessels are to be built, the work being shared between Scotts' Shipbuilding and Engineering Co. Ltd., Greenock, and the Burntisland Shipbuilding Co. Ltd.

All the vessels are to be propelled by reciprocating steam engines. Six of them will be passenger steamers about 350 ft. in length; six will be smaller passenger vessels, and the remainder will be cargo boats of nearly 8,000 tons. The total value of the contract is approximately £2,000,000.

Captain Campbell's New Record

Although Captain Malcolm Campbell failed to establish a new world's land speed record at Verneuk Pan in his Napier-Arrol-Aster "*Bluebird*," he succeeded in setting up new figures of 212 and 211 miles an hour for distances of five miles and five kilometres respectively.

His attempt to surpass Sir Henry Segrave's speed record of 231 miles an hour was attended by a great deal of bad luck. It was decided early one morning to make the attempt straight away, as conditions were ideal. Many private owners of motor cars who had come to watch Captain Campbell were driving all over the Pan, however, and by the time the stewards had cleared the track a strong wind had risen, and it was impossible for the attempt to be made. On another occasion everything was prepared, but at the last minute the attempt had to be abandoned owing to a defect in the timing aparatus.

When Captain Campbell broke the five mile and the five kilometre records it was reported that on one occasion the car skidded for over a mile! The car was bumped very badly during the run, and it is not expected that it will be possible to use it again. Before leaving Verneuk Pan, Captain Campbell re-christened his car "*Bluebird Pan*," and expressed the hope that one day he would return to undertake another attempt on the speed record.

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The Fairfield Shipbuilding and Engineering Co. Ltd., Glasgow, are to build a fourth twin-screw motor liner for the Bibby Line. In successive years the same firm have already built the "*Shropshire*," the "*Cheshire*" and the "*Staffordshire*," and like its predecessors the new vessel will be of about 10,000 tons gross, and will have machinery of the Sulzer type. It will be a little larger than the "*Staffordshire*," which was built last year, and will incorporate many improvements as a result of experience gained with the vessels previously built for this line.

These interesting ships carry passengers and cargo between Great Britain, India, and Burma, calling at several intermediate ports.

Flood Water Control in California

A dam that will rank as one of the highest in the world is now being constructed over the San Gabriel River at a point some 50 miles to the north of Long Beach, California. Its object is to provide a supply of water sufficient to meet the requirements of the eastern half of Los Angeles county, and it will also be of great value in preventing floods in the San Gabriel valley. The scheme of flood water control of which this dam forms a part was commenced over 12 years ago.

The coastal area of Southern California between the mountains and the sea has greatly changed in character during the past few years. Originally it was practically a semi-desert, supplied with water only during the rainy season when torrential rivers raced through its valleys. When the first white inhabitants settled there they secured a regular water supply by sinking artesian wells. This arrangement served for a time, but as the population increased and the supply of underground water grew steadily less, it was realised that unless the flood waters were impounded by dams a water famine would result sooner or later.

The first step to ensure an adequate water supply was taken in 1916 when the Government constructed a flood control channel to an ocean outlet at Long Beach. The next move was made in 1924, when a sum of approximately £8,750,000 was voted for the construction of a series of dams in the mountains. Of this scheme of dams the San Gabriel project will be the largest. It will drain an area of 212 square miles and impound 240,000 acre feet of water.

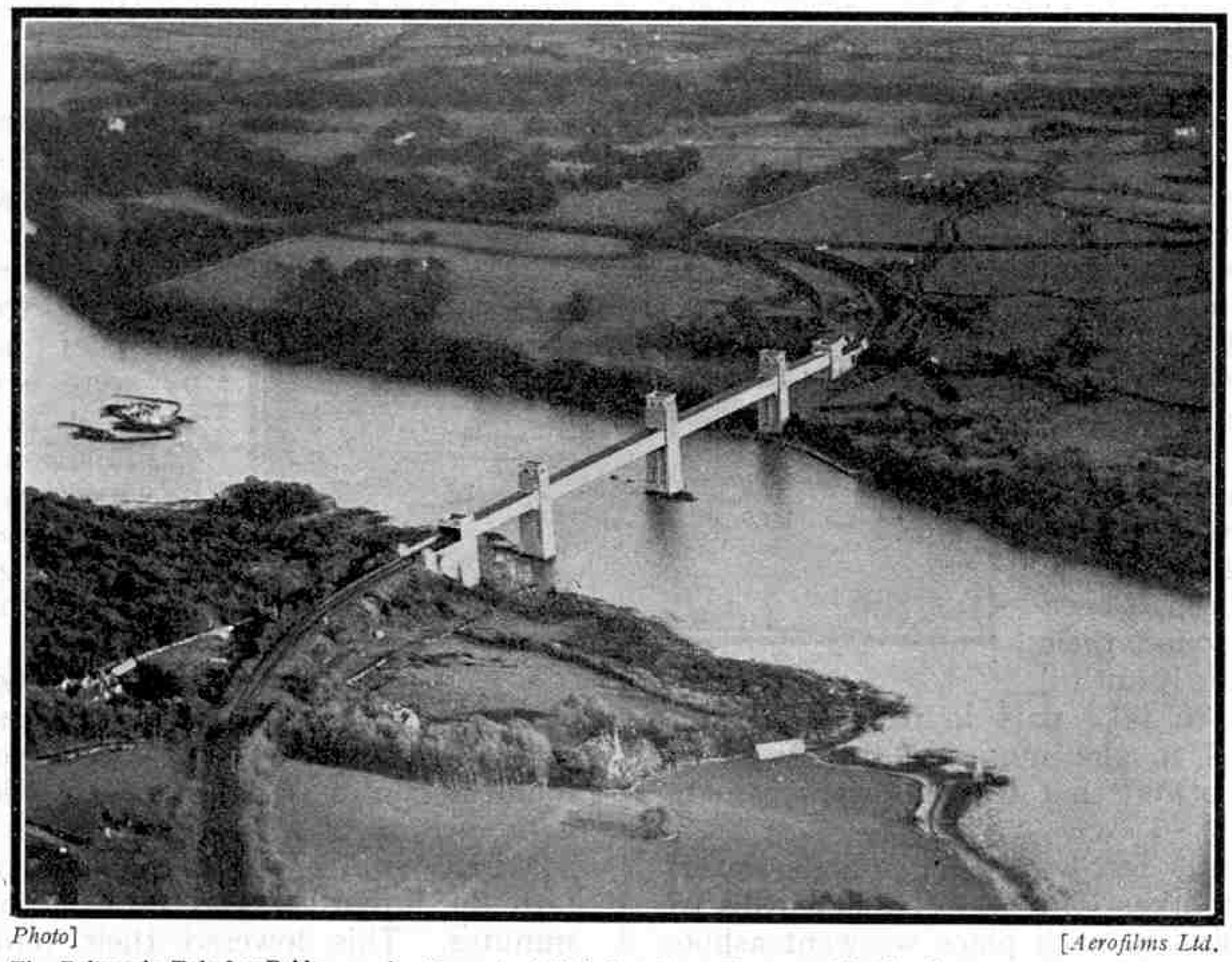
The San Gabriel dam is estimated to cost £6,250,000. It will be 425 ft. in height, its foundations being sunk in solid rock to a depth of 60 ft. Approximately 4,225,000 cubic yards of concrete will be required to complete the work, which is expected to occupy 1,800 men for about five years.

* * * *

At a quarry in Maine, U.S.A., a block of granite has been freed that may be the largest ever separated in one piece. It weighs about 50,000 tons and is 200 ft. in length, 75 ft. in width and 40 ft. in height. This massive block has a volume of 600,000 cu. ft. It is not likely to remain in one piece, for it will be split up into portions that are more convenient to handle.

It is interesting to compare this piece of granite with the world's largest concrete block. This is the roof of a building at Alexandria, Virginia, and occupies 25,740 cu. ft., or only one fortieth of the newly freed block.

Bridges from the Air: No. 6



Photo] [*Aerofilms Ltd.*

The Britannia Tubular Bridge carries the main L.M.S. line from Euston to Holyhead across the Menai Straits, separating the Isle of Anglesey from the Welsh mainland. Slightly more than 500 yards in length and consisting of two continuous tubular beams, one for the up and one for the down line, the bridge was built by Robert Stephenson in 1844. The centre pier rests upon the Britannia rock from which the bridge takes its name

Geared Motor Liner's Maiden Voyage

On the last Saturday in March the new Hamburg-America motor liner "*St. Louis*" called at Southampton on her maiden voyage to New York. This 17,000 ton vessel is propelled by four double-acting geared oil engines that develop 12,600 b.h.p. at 225 r.p.m. and are designed to give a normal speed of 16 knots. They are of the two-stroke Bremer-Vulkan-M.A.N. type, the diameter of the six cylinders being 485 m.m. and the stroke 660 m.m. They use 58 tons of oil daily.

The chief interest of the "*St. Louis*" lies in the use of gearing, the normal engine speed of 225 r.p.m. being reduced to 110 r.p.m. at the propellers. Helical gears are used and between them and the engines is a non-reversible hydraulic clutch.

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Shipbuilding Activity in 1928

During 1928 shipbuilding activities in Great Britain showed a decline. At the beginning of the year the shipping under construction amounted to 1,579,713 tons, but by the end of September this had decreased by nearly 500,000 tons. Fortunately things improved during the remaining part of the year, and at the beginning of the present year, 1,242,794 tons were on the stocks. The improvement has continued and on 30th March the tonnage under construction had increased to 1,357,375. This included 328 ships of all sizes, of which 243 were steamers and 78 motor ships.

It is interesting to compare this total with the tonnage under construction in other countries. At the end of the March quarter 1,480,437 tons of shipping were being built abroad, this figure being 123,062 tons higher than the total under construction in Great Britain and northern Ireland.

Proposed Tunnel between Sweden and Denmark

Some 40 years ago a proposal was made to link Sweden and Denmark by means of a tunnel between Malo and Copenhagen. Detailed plans were prepared and the matter was very fully investigated, but eventually the scheme was dropped for the time being. It has now reappeared, but this time it is proposed that the tunnel should be bored from a point a little southern of Helsingborg, Sweden, to a point between Elsinore and Espergarde in Sealand, where the distance to be tunnelled is only about a quarter of that between the points included in the original scheme. The tunnel will be slightly over five miles in length, and at its deepest point will not need to be more than approximately 44 yards below sea level. The cost is estimated at approximately £6,250,000, of which each country would find half.

Another new scheme, also tending greatly to speed up traffic between Scandinavia and the Continent, provides for a steam-ferry connection between Denmark and Germany, which will partly supersede the existing Gedser-Warnemunde service. The service will run between Rodby, in the island of Lolland, and a point in the island of Fehmern, the exact position of which has yet to be determined. The length of the route followed will be about 11 miles, thus comparing very favourably with the 26-mile sea journey of the Gedser-Warnemunde service. Another great point in favour of the proposed route is the fact that it may be possible to maintain operations throughout the whole of the year, an important advantage not possessed by the existing ferry service. A subsidiary undertaking necessary for the full advantages offered by the Rodby-Fehmern route to be utilised will be the bridging of a waterway south of Sealand. The cost of this bridge, together with other work that will have to be carried out before the service can be inaugurated, is estimated at £3,125,000.

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New Generating Station at Sheffield

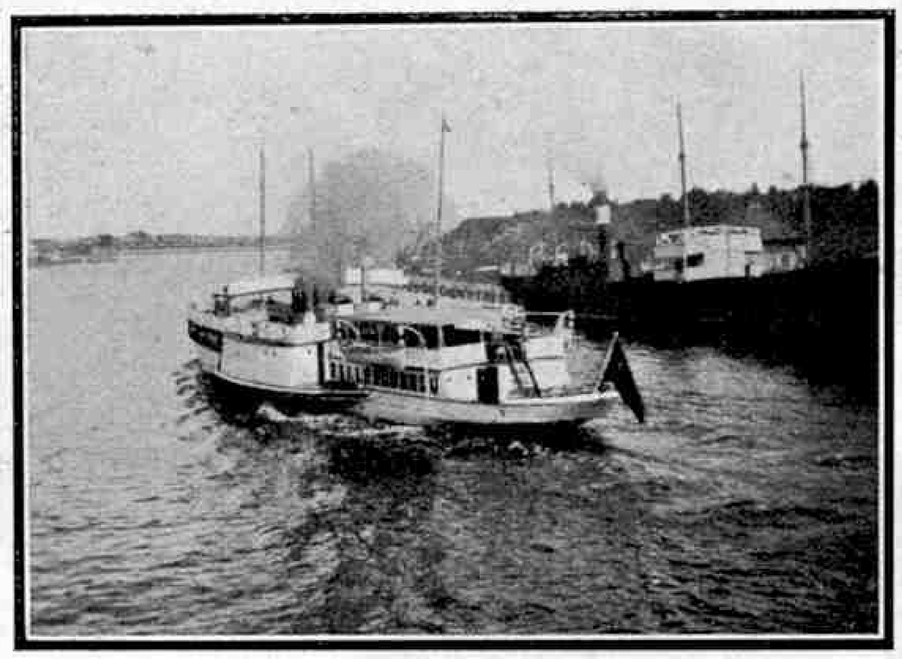
Under the scheme adopted by the Central Electricity Board a new generating station is to be built at Blackburn Meadows, Sheffield. This is intended to supplement an emergency power station built in war-time, and when it is completed it will replace both this and the older Neepsend station at Sheffield. Contracts to the value of £542,901 have already been placed, these covering not only the erection of the building, but also the provision of boilers, turbo-alternators, transformers, and other electrical plant.



A Trip Up the Baltic

An excellent way of spending a summer holiday is to make a voyage through the Baltic Sea. Two years ago I had the good fortune to enjoy a trip across these waters, and I found every minute of the time wonderfully interesting. I boarded the T.S.S. *"Baltara"* at Hayes Wharf, London Bridge, one Friday evening, and when I awoke on Saturday morning the vessel was out in the open sea. I felt rather queer, for this was my first voyage, and I did not find my sea-legs until Sunday.

The passage of the Kiel Canal was the first break in the voyage. After negotiating the entrance locks we journeyed slowly through the canal, and one by one the unfortunate people who had been ill in the North Sea found their way on deck to enjoy the beautiful air and scenery, and to take part in deck games. I was greatly interested in the numerous bridges that cross the canal and noticed that the majority of them are of the arch type.



On the river approaching Dantzig

Fortunately the Baltic Sea was calm, and its waters as still as those of a lake. Our vessel made calls at Dantzig and Memel, and at each place we went ashore for a short time. I found Memel particularly interesting, for it is a quaint little place, and during my walk through the town I only saw two motor cars. The *"Baltara"* is the largest ship that enters this port, and when we left practically all the inhabitants of the town turned out in order to bid us good-bye.

Soon after leaving Memel we reached Libau, the most northerly point of our voyage. A friend who lives in the town took me for a motor drive through the district, and I was greatly struck by a wonderfully impressive church that we passed. Its architecture is Byzantine in character, and it is crowned by several large domes. The stone of which it is built is grey granite, and as it is lined with gilt paint, it has the appearance when seen from a distance of being made of gold and silver.



A wonderful church at Libau. When seen from a distance it has the appearance of being made of gold and silver

Leaving Libau, the bows of our vessel were pointed homeward, our only call on the return trip being at Dantzig. As we approached the Kiel Canal we took part with three other ships in an exciting race to reach the locks first, our vessel winning by a narrow margin. A quick passage through the canal and a smooth voyage across the North Sea brought us back to London once more. R. CARR (Wanstead, London).

Blasting with Liquid Air

Some time ago I was one of a party of boys who were invited to see how blasting was carried on in iron mines situated near my school. We were informed that liquid air was used for this purpose, and consequently expected to find the experience very interesting indeed. In this we were not disappointed.

On arrival at the mines we found that the holes for the charges of explosives were being bored in the usual manner by means of pneumatic drills. Near by were several large tin cans about 4 ft. in height. On examination these turned out to be what may be described as giant thermos flasks, made of metal instead of glass, and containing liquid air that boiled rapidly on exposure to the air. The actual cartridges were simply cardboard cylinders about 1 ft. in length and 3 in. in diameter. One of them was split open for our benefit, and was found to contain sawdust and powdered coke, along with a proportion of a metallic powder.

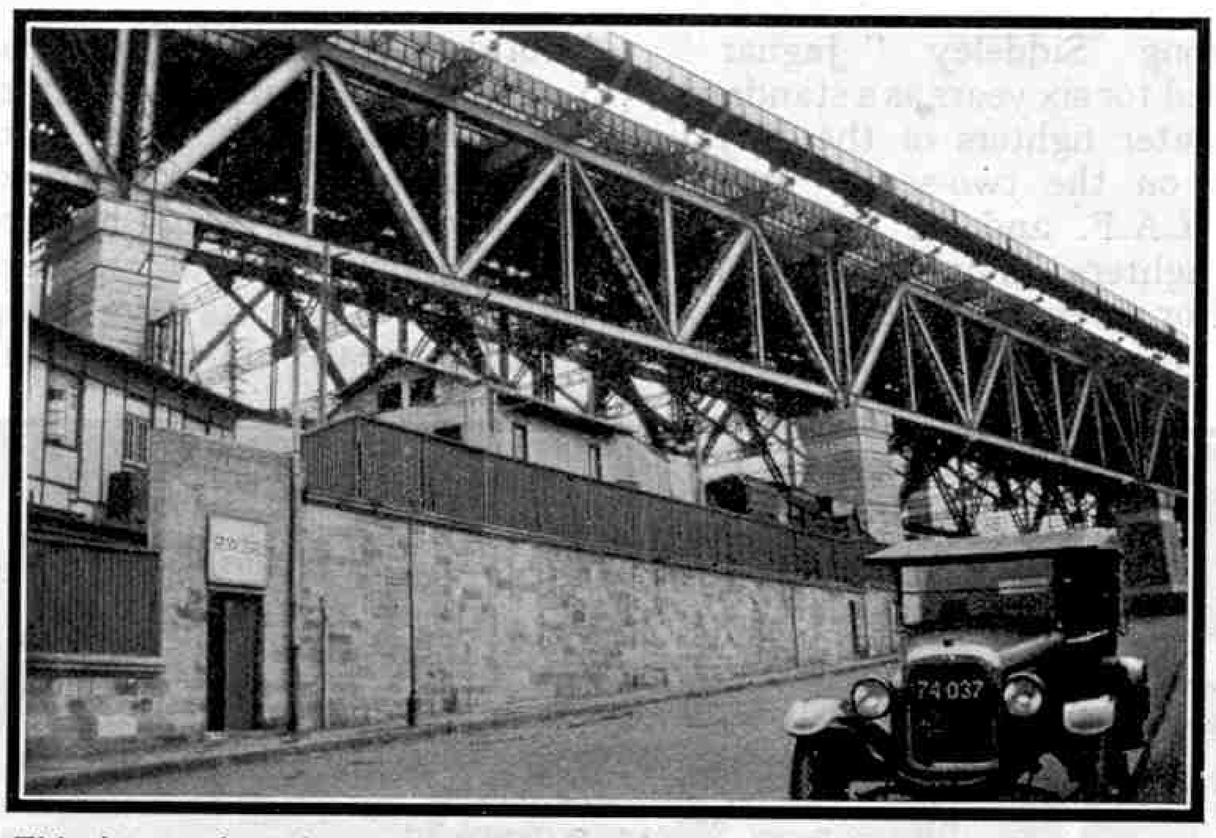
When required for use the cylinders were dropped into the liquid air and allowed to soak for about five minutes. This lowered their temperature so greatly that on being taken out they were immediately covered with frost, and in order to avoid injury the men handling them were compelled to toss them from hand to hand continually. Detonators were fixed into the cartridges and they were lowered into the holes, which were then filled with tightly rammed earth.

The touch of a button exploded the detonator, and this in turn fired the cartridge, which exploded with a dull boom. Stones flew in all directions, and on approaching the scene it was found that the ground now was so honeycombed with cracks that it was a simple matter for a steam shovel to transport the iron ore to waiting trucks.

The exact composition of the cartridges is a trade secret, but it seems to me that the metallic powder becomes so thoroughly saturated with liquid air that oxidation occurs with great rapidity and thus an enormous quantity of heat is produced. The combustion of the materials in the cartridges is almost instantaneous and therefore is explosive in character. The use of liquid air for blasting in this manner is certainly very simple and at the same time appears to be safe, for the explosive mixture is not made until required. R. R. S. BENNETT (Oundle).

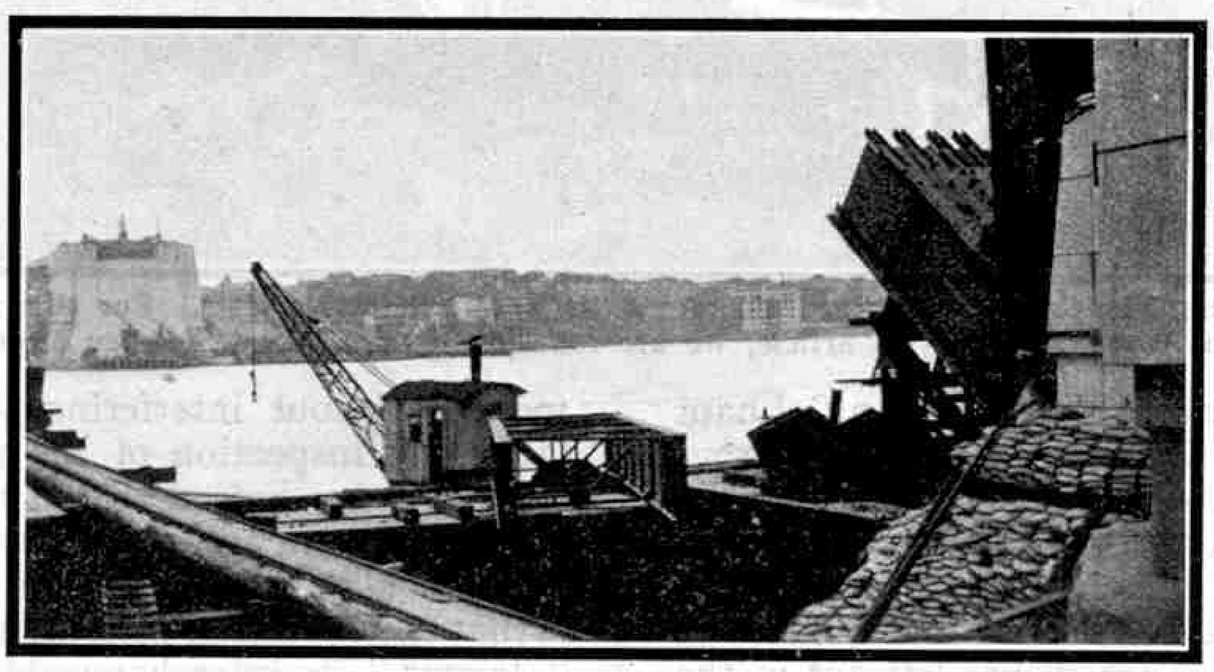
Progress of the Sydney Harbour Bridge

In the early part of this year I had the pleasure of paying a visit to Sydney, where I was able to see the progress that had been made with the construction of the bridge that is being built across the famous Harbour. The five approach spans on each shore have now been completed, and their massive proportions enabled me to gather some idea of the wonderful spectacle that the bridge itself will present when completed. The spans on each side of the river are 135 ft. in length, and are sufficiently wide to carry four sets of electric rails, a roadway for six lines of traffic and also two paths for foot passengers, each of which is 10 ft. in width.



This impressive photograph shows the approach spans on the south side of the Sydney Harbour Bridge now under construction

The skewbacks also are finished. The pressure on their inclined faces is 800 lb. per sq. in., but the thrust is spread over a greater area of the sandstone foundation on which the weight of the bridge eventually rests, and there it is only 200 lb. per sq. in. The building of the main pylons, or abutment towers, has been carried as far as the deck level. Although they have not reached their full height, the towers already present an imposing appearance when seen across the river. On the south side of the Harbour the "creeper" crane that will be used in the erection of the steelwork has already been placed in position. When I visited the bridge the first panel on this side had almost been completed, and by this time the "creeper" will have moved along it to begin the construction of the second.



Looking across Sydney Harbour from the southern abutment tower. On this side a beginning has been made with the construction of the steelwork

It is wonderful to think that this bridge will ultimately have a capacity of 168 electric trains, 6,000 road vehicles and 40,000 foot passengers per hour! The deck of the bridge will be very firmly laid, for it will have to stand very heavy strains from this immense traffic. It will have a total width of 150 ft. and will carry four lines of railway, a road 57 ft. in width, and two footpaths each 10 ft. in width.

It will be remembered that the total length of the arch and bridge spans is to be 3,770 ft., and the height to the top of the arch will be 450 ft. above high water. The central span will have a clearance of 170 ft. above the water at mean high tides, so that practically all large ships—with the exception of such vessels as the "*Olympic*"—will be able to pass beneath the bridge.

KEITH JARROTT (Brisbane, Australia).

Fire-Fighting in Coal Mines

One of the most greatly-feared of the many catastrophes that may occur in a coal mine is an outbreak of fire in one of the galleries, for this is always a source of great loss and may give rise to serious explosions. Fighting an underground fire is a very difficult task, for as a rule water is lacking, and in addition it often is impossible to approach the fire because of the heat and the great volume of thick smoke and noxious gas that is produced. The only practicable method of dealing with an outbreak of any magnitude is to seal off the gallery in which it occurs and thus put out the fire by cutting off the supply of air.

Sealing off a portion of a mine is very interesting work. The first step is to build an ordinary brick wall across the air inlet passage. This presents no difficulty, but the building of the second wall that completes the isolation of the gallery in which the fire is raging must be carried out very carefully, for sudden sealing may cause such a rise in temperature and pressure in the space within the walls that a disastrous explosion follows.

What is called "a sealing wall" really is composed of two walls built about four yards apart. Through them pass three long pipes, and the remainder of the intervening space is tightly packed with sand in order to strengthen the barrier. Of the three pipes one is 3 in. in diameter and is provided with a tap; the others are 18 in. in diameter, and are situated about halfway up the wall. At their inner ends are platforms on which rest bags of sand of the same diameter as the pipes. To these are attached ropes that pass through the pipes, and when all is ready for sealing, the bags are slowly drawn into the openings in order to cut off the supply of air to the burning coal. Any explosion that may take place merely blows the sandbags out of the pipes, instead of expending its energy on the destruction of the wall.

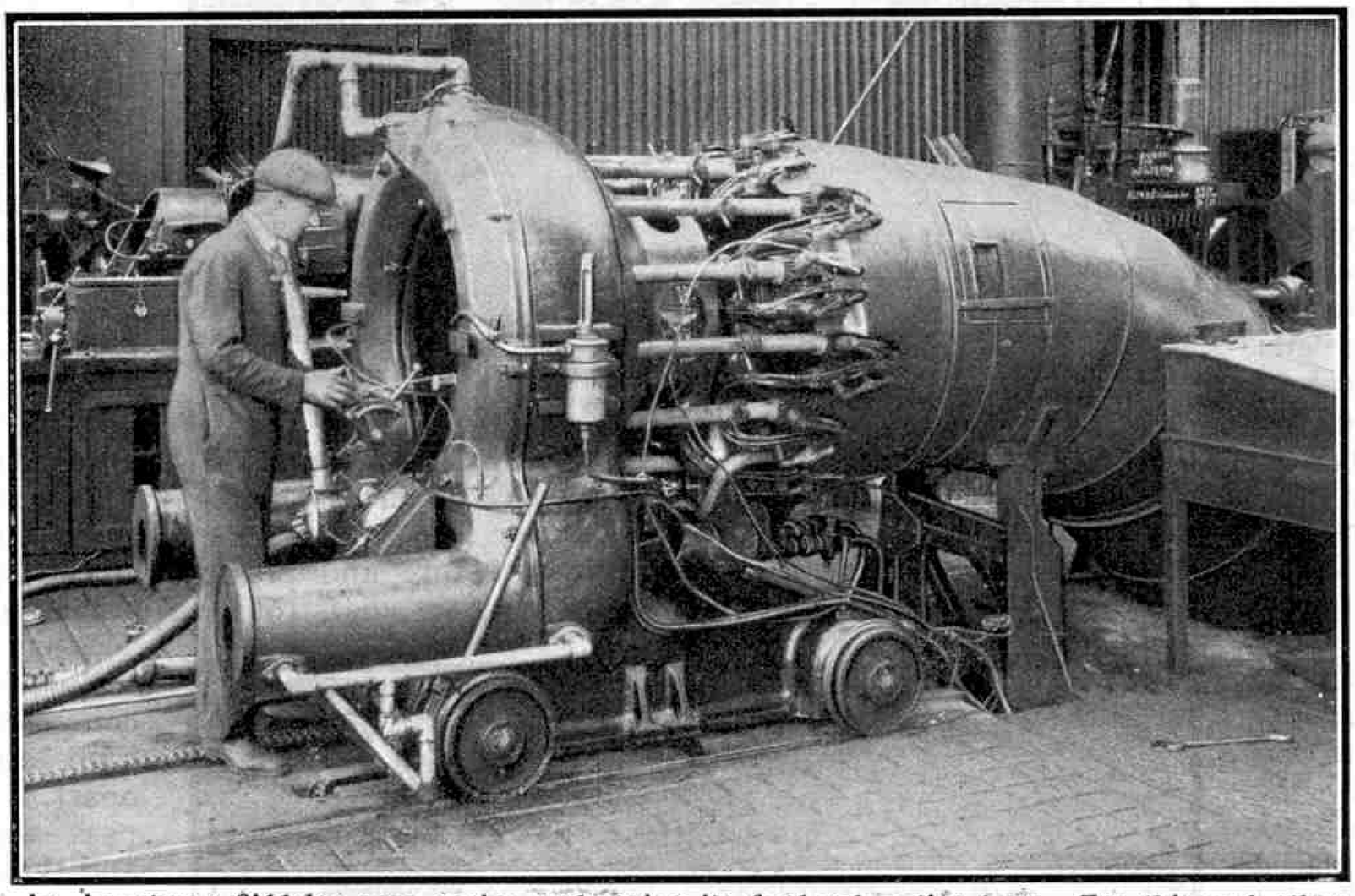
The 3 in. pipe fitted with a tap is always placed near the roof of the gallery, and is used for testing the temperature in the sealed portion of the mine. Samples of gas also may be drawn out through it, and its presence enables experienced mine inspectors to find when the fire has burnt out, and it is safe to re-open the gallery.

T. O. DAWSON (Tyldesley, Manchester).

Famous Aero Engines

VII.—The Armstrong Siddeley "Jaguar"

THE air-cooled Armstrong Siddeley "Jaguar" engine has been employed for six years as a standard engine for the single-seater fighters of the Royal Air Force. It is used also on the two-seater reconnaissance machines of the R.A.F. and on the reconnaissance machines, deck fighters, flying boats and seaplanes of the Fleet Arm. For several years "Jaguars" have been flying daily on the London-Paris airline, where, on Imperial Airways "Argosies," they have established a period of 400 hours between overhauls, together with a remarkable record for reliability and economy. Today, the total flying time of the three triple-engined "Argosies" is approaching 5,000 hours, so that the total distance covered is between 400,000 and 500,000 miles.



An Armstrong Siddeley aero engine undergoing its final exhaustive tests. For this and other illustrations reproduced in this article, we are indebted to Armstrong Siddeley Motors Ltd.

It was an air-cooled Armstrong Siddeley "Jaguar" engine that Sir Alan Cobham flew from London to Cape Town and back, and from England to Australia and back. During these flights the utmost extremes of temperature were encountered, but neither the cold of the Alps nor the intense heat of the Equator affected the engine at all. The same engine was used on both flights and, although it was left out in the open on many occasions, its inspection at the end of its 44,000 miles' flying showed practically no trace of wear.

The "Jaguar" is now produced in two types. One is fitted with a three to two reduction gear, and the other with an extremely efficient type of supercharger.

The first type is particularly suitable for civil use and for low altitude heavy-duty machines. Its 14 cylinders and reduction gearing provide a remarkable smoothness of running, great propeller efficiency and, owing to the large number of revolutions per minute thus made possible, the engine has a very large reserve of power.

The supercharged model is suitable for Service requirements in cases where it is desired to maintain the power and performance at high altitudes. This model has been used successfully in many squadrons of the R.A.F. for more than three years, and the claim is made that this is the first practical supercharged engine in the world to be fitted as standard to Service aircraft.

Many important improvements are incorporated in the latest "Jaguar" engines. For instance, metal parts are now specially treated to prevent corrosion by sea water. Modifications in design have resulted in better cooling, a larger power output and greater fuel economy; while other developments have brought about increased ease of upkeep, greater durability and a maintenance of power over still longer periods.

Both types of engine possess certain features of special importance. For a given power their overall diameter is smaller than that of any other air-cooled engine, and the radial arrangement and special design of the cylinders accounts for their extraordinarily efficient cooling. The radial arrangement of the cylinders also enables any one to be removed without interfering with the others, and thus facilitates inspection of the pistons. Accessibility and simplicity are indeed two of the outstanding features of the design—an important point in cases where skilled labour is not always available. A further point of interest is that the cylinders, pistons, and many other parts of the "Jaguar" are interchangeable with those of the 215-225 h.p. "Lynx" and the 130-140 h.p. "Mongoose" engines. The design of these three units is, in fact, so similar that when they are all in service a mechanic familiar with one is perfectly competent to look after either of the others.

The engines are produced on a large scale in a modern factory equipped with the finest machine tools obtainable. Every part is subjected to the most rigorous test and scrutiny, special inspection departments having been created for this purpose. All components are strictly interchangeable, and no hand fitting is necessary—a result that has been attained by careful study of design and by the excellence of the machine shop methods employed. Owing to the fine limits used in the machining, and the abolition of hand fitting, the engines are uniform and do not vary in horse-power to any appreciable extent.

The "Jaguar" 460 h.p. engine is of the air-cooled radial type, having two banks each of seven cylinders

disposed on a two-throw crankshaft set at 180°. Each set of pistons drives a crankpin through one master rod to which are coupled six auxiliary rods. Cylinders of a composite construction are used, consisting of a head, barrel and lock nut which, when assembled, form one unit. The cylinder head is an aluminium casting with expanded valve seats of aluminium bronze alloy, screwed when hot on the cylinder barrel and locked with the locking ring, which is shaped to act as an extra cooling fin. The cylinder barrel is machined from a solid steel forging, the radiating fins being turned eccentrically around the barrel. When the cylinder is screwed into the engine body the shallowest radiating surface faces forward, so that distortion from excessive cooling is eliminated.



A portion of the huge Armstrong Siddeley works, where motor cars and aero engines are produced side by side

The cylinders are screwed into a light steel adaptor flanged and pinned into the crankcase, and are secured by a double cone locking ring. When the cylinder is correctly placed the locking ring is tightened. The pistons are forged from a special alloy metal combining the requisite strength of material with adequate heat-conducting properties.

Two cast iron gas rings and one scraper ring of the same material are provided above the gudgeon pin bearing, the scraper ring preventing any excess of oil finding its way into the combustion chambers. This effect is further enhanced by a chamfered groove immediately below the scraper ring, which is drilled with numerous holes. Holes are drilled also in the scraper ring and its groove, so ensuring the escape of surplus oil.

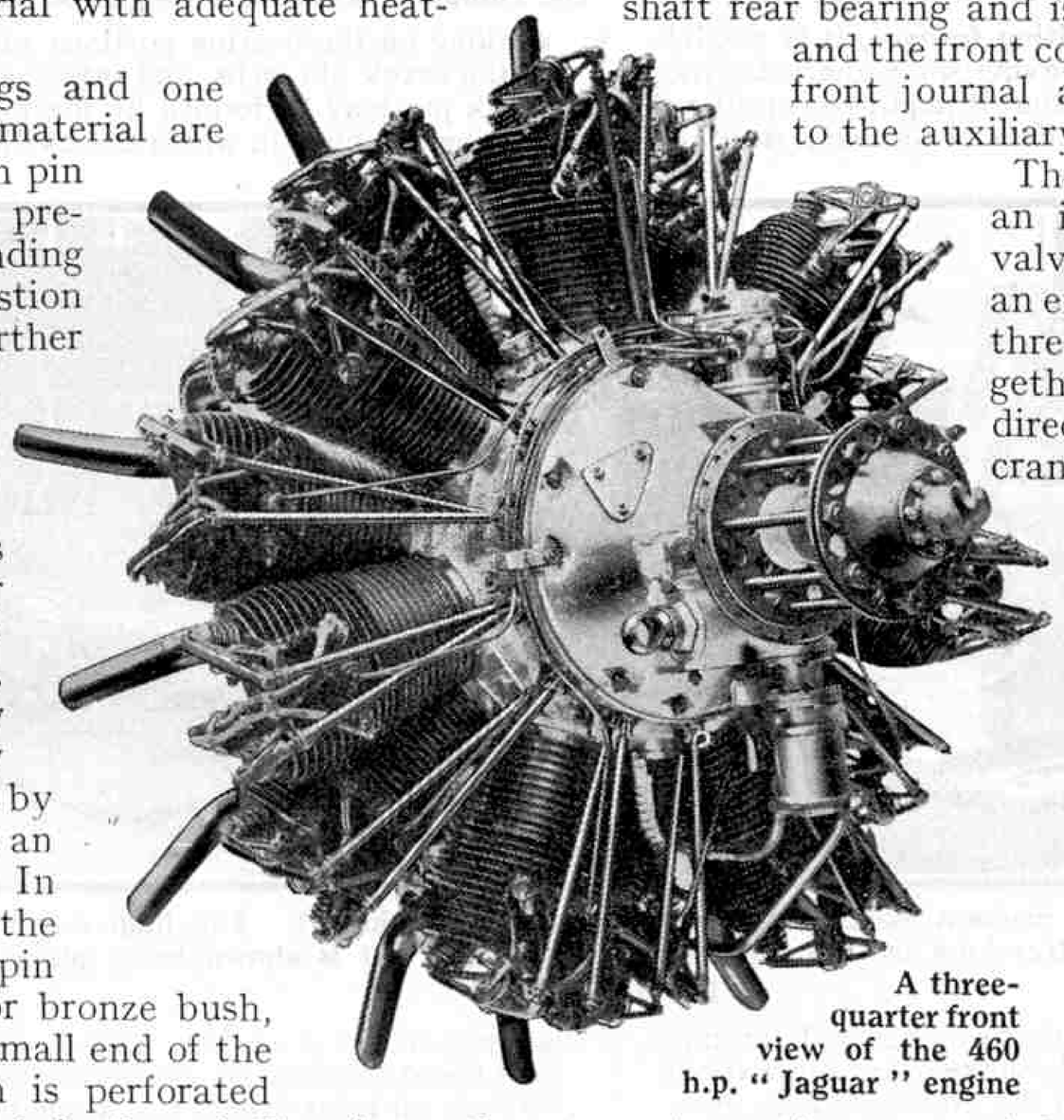
The large diameter hollow gudgeon pin is of the fully floating type and is secured by a spring clip expanded into an annular groove at each end. In addition to being free in the piston bosses, the gudgeon pin is also loose in its phosphor bronze bush, which in turn floats in the small end of the connecting rod. The bush is perforated with holes that ensure the lubrication of all surfaces, the oil entering through a large hole at the top of the small end of the connecting rod.

The connecting rods and master rings are of high tensile steel machined all over to definite weights to ensure accurate balance of rotating and reciprocating parts.

The white metal crank pin bearing is cast direct into the master ring, which is formed partly by a cap and partly by the base of the master rod, the two parts being then bolted together. The six auxiliary rods are of tubular section and work on similar pins, which are a floating fit in steel bushes held in these webs. All eight pins are positioned endwise by circlips.

The crankshaft carries bronze balance weights on its outer webs, and is supported on three journal roller bearings and located by a double-acting ball thrust bearing at its front end. The rear end of the crankshaft carries the induction fan. The drives of the cams and oil pump are all taken off the front end of the crankshaft, while the drive for the magnetos is taken off the rear end, a special splined shaft being provided for the purpose.

The aluminium engine body is made in three parts—the crankcase, carrying the cylinders, tappet guides, and engine bearer; the back cover, which carries the crankshaft rear bearing and is also the induction fan casing; and the front cover, which carries the crankshaft front journal and thrust bearings, in addition to the auxiliary drives.



A three-quarter front view of the 460 h.p. "Jaguar" engine

There are two valves per cylinder, an inlet and an exhaust. All the valves are operated by two cam rings, an exhaust and an inlet, each bearing three cams. Both rings rotate together at one-sixth engine speed in a direction opposite to that of the crankshaft. The cams are driven from the front end of the crankshaft through two sets of back gears carried by a bracket secured to the front of the front case, inside the cover.

The engine is lubricated on the standard "dry sump" system. Two pumps, "feed" and "scavenge," of the gear type, are fitted, the scavenge pump being of about 20 per cent. greater capacity than the feed pump. Oil is drawn from the tank and forced by the feed pump through a filter to the reciprocating parts of the engine, via the hollow crankshaft, at the rate of about $2\frac{1}{2}$ gallons per minute. All the oil released inside the engine drains to the sump, whence it is returned to the tank by the scavenge pump by way of a jacket cast around the induction casing.

Forging Fifty-Ton Crankshafts

A Triumph of Engineering Skill

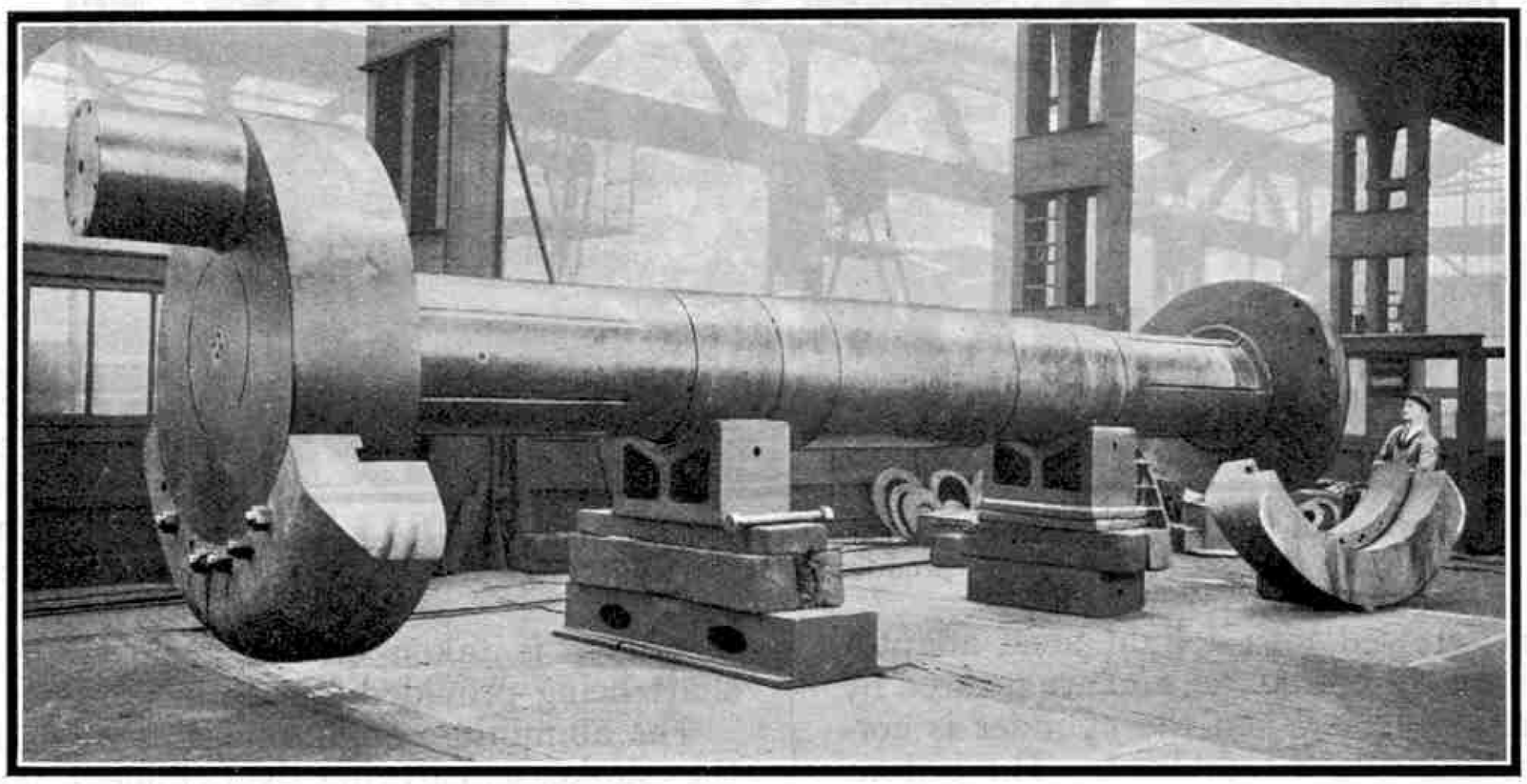
(Continued from last month)

LAST month we described the processes entailed in the forging of a modern crankshaft, and this month we propose to describe briefly how the finished shaft is produced.

Before doing so, however, we may mention that whereas very many shafts are made of ordinary Siemens Martin ingot steel, they are sometimes made of special steel alloys to suit particular conditions. Nickel or nickel chromium steel is largely used, the latter in particular where the working stresses are very high. The use of chromium steel also provides the further advantage that the shaft is immune from many of the more serious corroding influences.

For many years the corrosion of iron and steel has engaged the attention of engineers and scientists. After prolonged experiment it was discovered that by adding from 12 to 14 per cent. of chromium to steel while it is in the melting furnace, it is possible to produce a perfectly uniform metal having some characteristics so different from those of ordinary steel that it might be considered a different metal. For instance, if drillings of ordinary steel and of chromium steel are placed in separate glass vessels and nitric acid is poured over them the ordinary steel drillings dissolve with the production of great heat, and dense brown fumes, whereas the chromium steel drillings are not affected. Nitric acid is one of the most powerful oxidising agents, and this experiment proves how great an advance has been made towards solving completely the problem of corrosion.

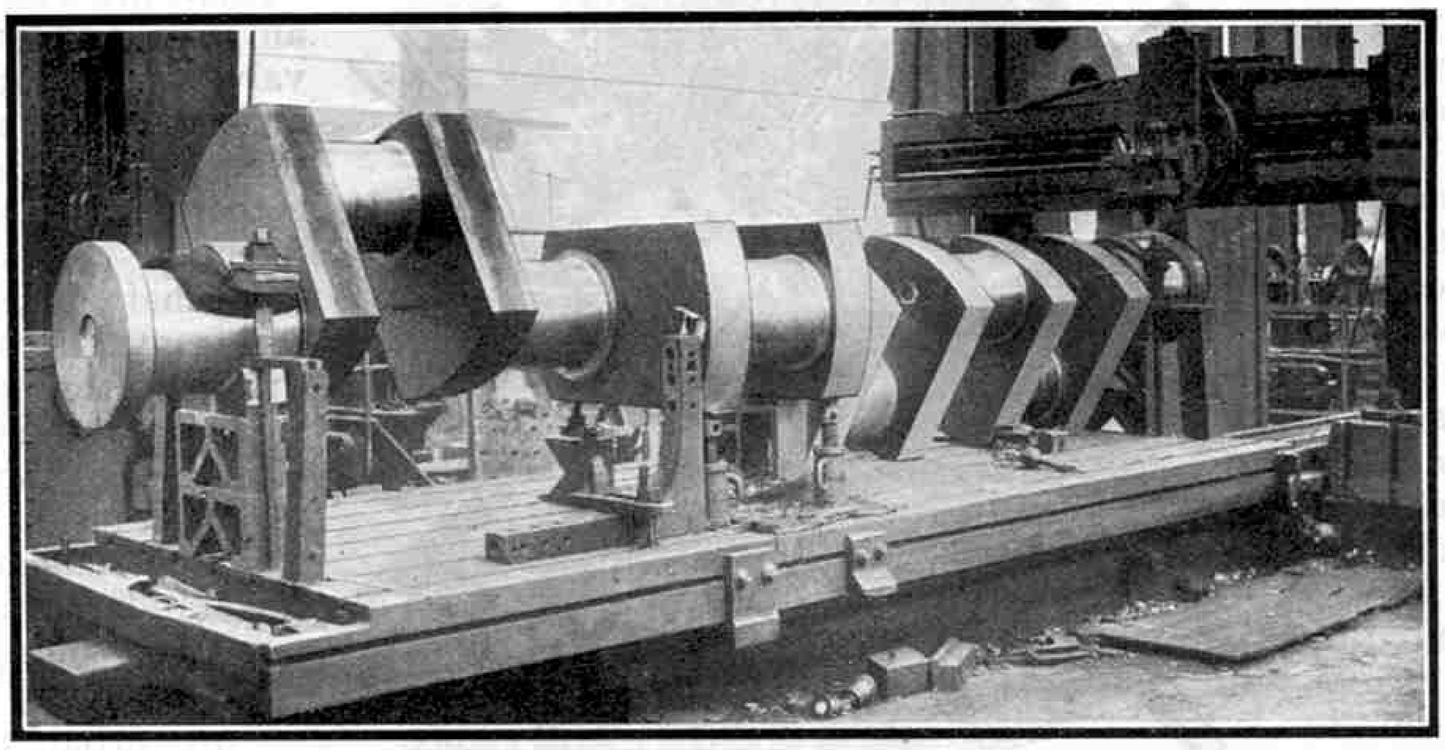
We must now pass on to the machine shop. In any large engineering works this shop is always one of the most interesting and important departments. Here it is that castings and forgings received from the foundry are machined to the required proportions as shown on the blue prints prepared in the drawing office. Here also are to be found precision machines of every variety including borers, milling machines, planers and lathes. Among all the interesting work turned out by a machine shop it is doubtful whether any entails more care and skill than the production of a large crankshaft. Not only is the shaft itself of interest, but the machines used in the course of its manufacture also are of the greatest interest. These fine machines work to limits of accuracy, which a generation ago would have been considered so fine as to be of service only in the most delicate scientific work. Some idea of the extent of this accuracy may be gained from the fact that it is customary to express the measurement of a large crankshaft as so many thousand millimetres.



A large Crankshaft built up by fitting two enormous combined Crank Arms and Crank Pins forged in one piece on to a forged steel shaft. The complete Crankshaft weighs 80 tons

When the forging has been made it is first sent to the annealing furnace where it is annealed. It then goes to the machine shop for the first rough machining. If the shaft is an exceptionally large one, it goes again to the annealing furnace for further heat treatment, and is then returned to the machine shop for the second machining known as "finish" machining.

A great variety of machine tools are employed in this process some working on the bearing portions of the shaft, others on the sides of the crank pin webs, and others again on the crank pins. Each crank pin may be formed by machining in a special type of crank pinning machine, in which the tool is rotated and the work remains stationary. Alternatively the process may be carried out in an ordinary crank lathe where the tool is stationary and the crank revolves between centres set out to the correct distances and angles on the flanged couplings at the end of the crankshaft, or on separate steel centre plates fitted on to the end of the shaft.



A solid forged Siemens Martin Ingot Steel four-throw Crankshaft. This huge forging is 5,720 millimetres long by 380 millimetres in diameter. It is shown being planed on a planing machine

After the second or perhaps third machining, the smaller crankshafts are finally finished by grinding. This process is not usually necessary or indeed possible with the larger shafts, which are carefully machined to size and finally finished by lapping in a "lead lap" fitted with emery and oil. As most high-speed crankshafts are lubricated by oil forced under pressure through oil holes drilled the whole length of the shaft with outlets to the surface machined in the journals and crank pins, the necessary oil journals have to be drilled in the shaft before it can be considered complete.

The majority of large crankshafts are made hollow so that greater strength may be obtained with a given weight of material, or on the other hand, a lighter shaft for a given strength. One

disadvantage of the solid shaft lies in the fact that the interior of a big forging is not so uniform in grain or so reliable in structure as are the outer portions. This entails a certain amount of risk that to a great extent can be eliminated by boring out the shaft, thus permitting inspection of the inside for possible flaws or other defects. A shaft of this type made recently for a three-cylinder triple-expansion engine of 23,000 h.p. had 16-inch diameter crank pins, each pin being bored out to an internal diameter of 8½ in. The body of the shaft was machined to an external diameter of 16 in. and an internal diameter of 8 in. throughout its entire length.

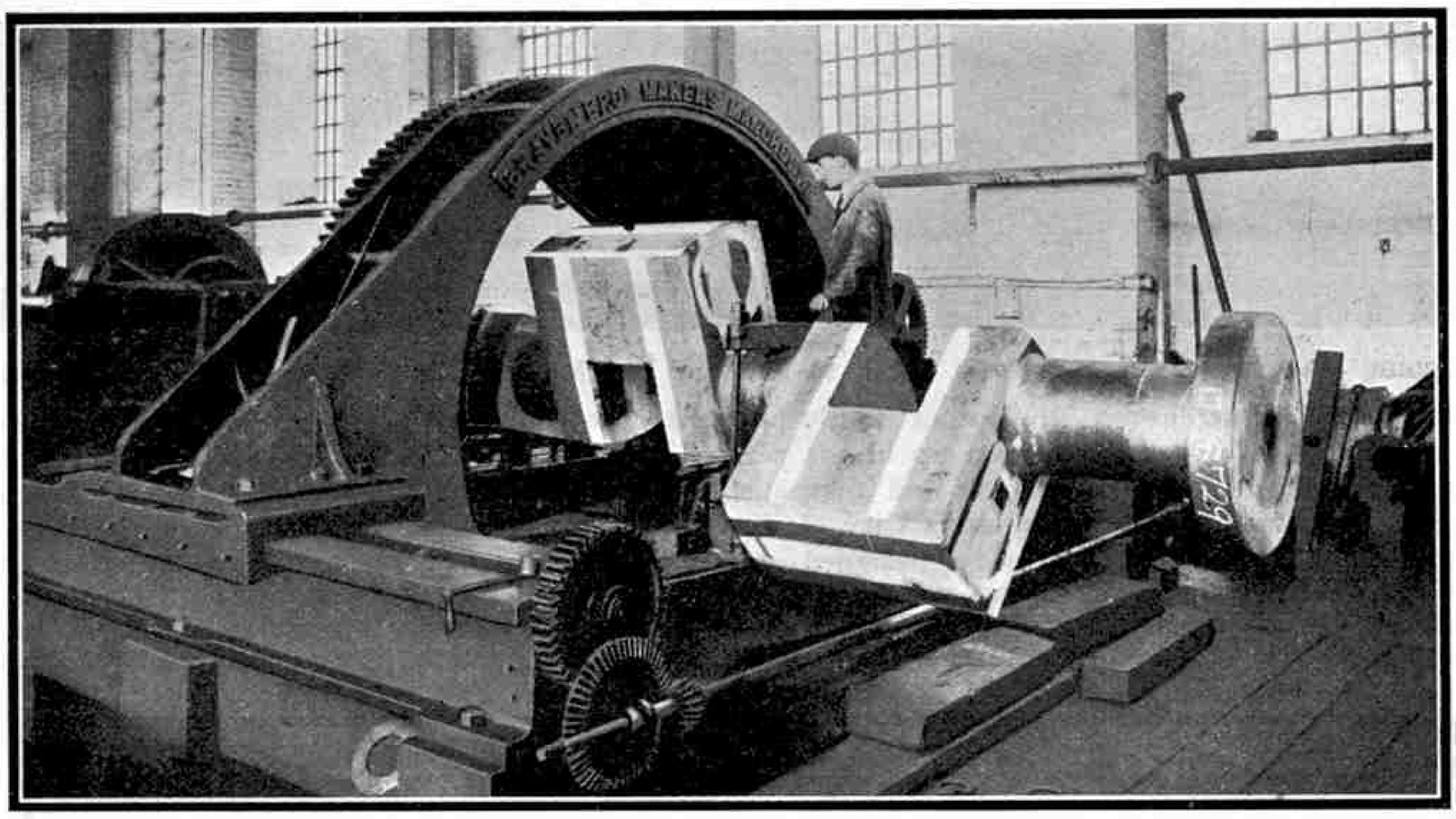
Smooth running is a most desirable feature in any engine, no matter whether it is of the small stationary type, or a 10,000 h.p. marine engine. As the majority of modern reciprocating engines are constructed on the triple-expansion principle, the movement of the crankshaft, rotated as it is under the influence of several distinct impulses, is sometimes jerky or spasmodic, so causing violent vibratory forces to be set up in the framework of the vessel, a most unsatisfactory feature of course.

To a great extent this vibration can be eliminated by the use of a balanced crankshaft. This is essentially an ordinary crankshaft but with weights attached to the webs, so placed that the turning moment of force created by the rotation of the web is diametrically opposed to the turning moment created by the crank pins. By this means the extra torque or twisting movement which, in the case of an unbalanced crank is applied to the shaft each time a crank pin turns over the upper "dead" centre and commences its downward stroke, may be eliminated.

In many of the best designed engines balance weights are not now used, but in their stead four cranks are provided. These are arranged radially around the shaft at different angles with respect to one another so that as each crank turns over the upper "dead" centre, one of the remaining three cranks is passing the lower "dead" centre.

Large marine crankshafts are manufactured usually as a single unit and the cranks and webs are in one piece with the cylindrical portions of the shaft. In some, however, the webs are first made as separate pieces and afterwards joined to the cylindrical portions of the shaft by "shrinking." Shrinking is a process used considerably in many branches of engineering, and in relation to crankshafts consists essentially in heating each web to such a temperature that the diameter of the hole in which the journal pin is to be secured expands slightly. When the hole has expanded sufficiently the crankpin is quickly placed in position and the whole job is then set aside and allowed to cool very slowly. As the web cools the hole contracts to its normal diameter again, with the result that the pin is gripped securely in position. The pin is additionally secured by means of keys, sunk partially into the shaft.

When high-power reciprocating engines first came into favour for marine working, the large crankshafts required were usually made in short lengths which, when completely machined and fitted, were coupled together to form one huge shaft. This method, of course, greatly simplified the process of forging and machining, as smaller lathes, etc., could be successfully employed. In a sectional shaft each separate length consists of a crank complete with its adjacent cylindrical shafts and flange couplings for uniting one length of shafting to another.



A heavy Crankshaft in position on one of the Crank-pinning machines mentioned in this article. For this photograph and those on the previous page we are indebted to Vickers-Armstrong Ltd.

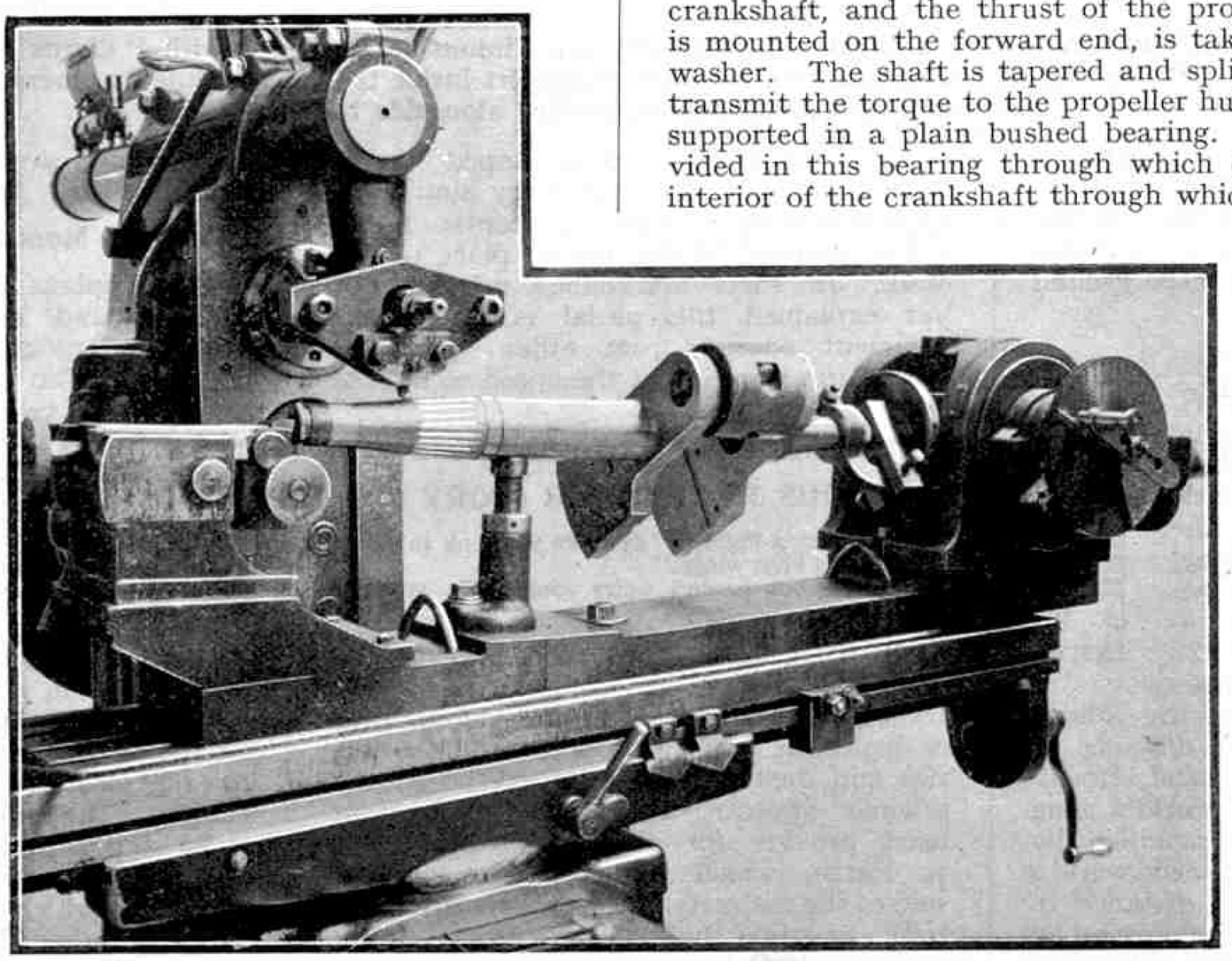
In the manufacture of radial aero-engines, such as the well-known Bristol "Jupiter" type, the excellent performances of which, both in long continuous runs on the test bench and also in the air, have earned this engine world-wide fame, the satisfactory results depend, of course, upon the production of a satisfactory design and the employment of suitable materials of construction.

By the courtesy of the Bristol Aeroplane Co. Ltd., we are able to give some particulars in regard to the manufacture of the crankshafts for these famous engines. The metal of which these crankshafts are composed is the finest quality of chrome-nickel steel, and the shaft is hollowed out for the sake of lightness. Good use is made of the hollow spaces for supplying lubricating oil to the crankpin and other vital parts. The cranks are of the balanced type, the balance weights being bolted to the crank webs, which are extended in the direction opposite to the crank-pin for this purpose.

Three roller bearings are used to carry the radial load on the crankshaft, and the thrust of the propeller, or air screw, which is mounted on the forward end, is taken on a double ball-thrust washer. The shaft is tapered and splined at the forward end to transmit the torque to the propeller hub, and at the rear end it is supported in a plain bushed bearing. Annular grooves are provided in this bearing through which oil can be passed into the interior of the crankshaft through which it flows to the crankpin.

An interesting operation in connection with the machining of the crankshaft may here be referred to. This is the method of producing the splines on the tapered portion of the shaft, by means of which the torque is transmitted to the propeller hub.

The splines are first rough milled in the ordinary way to within 0.002 in. of the correct depth for the whole of their length and then, at the larger end only, to 0.002 in. below the final depth of the remaining portion. This gives the necessary clearance for the entrance of a stationary form tool,



Finishing the Splines on the Crankshaft for a "Bristol Jupiter" Engine

(Continued on page 505)



Another Wing-flapping Machine

An ornithopter, in other words a machine designed to fly by flapping its wings bird-fashion, has been tested recently in Richmond Park, London. The machine is driven by man-power, and consists essentially of two bicycle wheels over which is fitted a light framework to which the wings are attached. A bicycle saddle and pedals are fitted in the framework. When the pedals are operated a flapping and slightly backward movement is imparted to the wings, and the inventor, Mr. E. Winter, has attained a speed of about 15 miles an hour along the ground.

Mr. Winter states, however, that the pedals alone would not be capable of lifting the machine from the ground, and he intends to add to his equipment a hydrogen container having a capacity of 1,000 cu. ft. This quantity of hydrogen is capable of lifting a load of nearly 70 lb., and Mr. Winter believes that the gas bag in conjunction with the pedal-operated wings will enable him to leave the ground and fly.

* * * *

Italian Airman Honoured

When the International League of Aviators met in Paris a short time ago they awarded the title of "The Best Aviator in the World in 1928" to Colonel Arturo Ferrarin, the well-known Italian airman. It will be remembered that during 1928 Colonel Ferrarin established three flight records. Accompanied by Major Carlo del Prete, he flew the distance of 4,453.9 miles from Rome to Natal, Brazil, which still constitutes the world's long distance record. Again accompanied by Major del Prete, he set up a new world's closed circuit record with a distance of 4,763.7 miles. Finally Colonel Ferrarin set up a new world's duration record of 58½ hours.

From Earth to Mars in Ten Minutes!

Another would-be visitor to Mars has turned up in the person of a professor of science and mathematics in a school at Oaklands City, Indiana, U.S.A. He has already designed a machine which, he claims, will be able to complete the journey from the Earth to Mars in from five to ten minutes! The machine, which is constructed of duralumin, is shaped like a huge pear, with a motor, very similar in appearance to a wireless circular frame aerial, perched at the top in place of the stalk. In some marvellous manner not yet explained this aerial is to extract sufficient energy from ether waves to propel the machine at the speed of light—186,000 miles per second. Landing gear is dispensed with, as the contrivance will rise and descend vertically. Wild as the scheme appears, the machine does at least provide for the inventor's return to Earth, which is more than can be said of the majority of the rockets that from time to time have been proposed for similar celestial journeys!



Courtesy] [*Westland Aircraft Works*

A striking photograph of the Westland Triple-engined Limousine, equipped with "Cirrus III" engines. It has seating accommodation for four passengers inside the cabin, while an emergency seat for a fifth passenger is provided alongside the pilot

THIS MONTH'S AIR STORY

Old Lady (to pilot during flight): "Why do you look so pale, my boy?"
Pilot: "We've lost both wings."
Old Lady: "Well, you needn't worry about that. We'll get new ones when we land!"

Air Service between Dublin and Croydon

A company has been formed to inaugurate an air service between Dublin and Croydon, and it has been stated that the Irish Free State Government probably will be prepared to grant a subsidy estimated at 2/6 per ton-mile, or approximately £25,000 per annum. It is proposed to run the service daily, the 300-mile flight between the terminal points occupying only about three hours. The service will make use of the international air ports of Baldonnel and Croydon.

In addition to this scheme it is proposed to link up the principal cities in the Free State by air routes, and to maintain a small air fleet at Queenstown so that it will be possible for passengers to disembark from trans-Atlantic liners and fly direct to England or the Continent, thus effecting a very considerable saving of time.

* * * *

Miniature Monoplane's Successful Trials

A monoplane that is claimed to be the smallest and cheapest in Britain has safely undergone its first trials at Brooklands. The machine was constructed by two R.A.F. officers, and was not assembled until immediately before the trials. These officers are determined to popularise flying by making it as cheap as possible and they have certainly achieved part of their object, for this machine can be constructed at a cost of less than £350. It is of very simple design, consisting of a fuselage and a one-piece wing that can be removed or replaced in three minutes by two people. The cruising speed of the machine is 85 m.p.h. and the petrol consumption one gallon for 40 miles. The total weight is 450 lb., which is only one hundredth of that of the Beardmore "*Inflexible*," the world's largest all-metal monoplane.

England-India Non-stop Flight

The Fairey long-range monoplane, details and a photograph of which were published in our last issue, left Cranwell Aerodrome, England, on the 24th April last, and completed the first non-stop journey between England and Karachi in 50 hours 38 minutes.

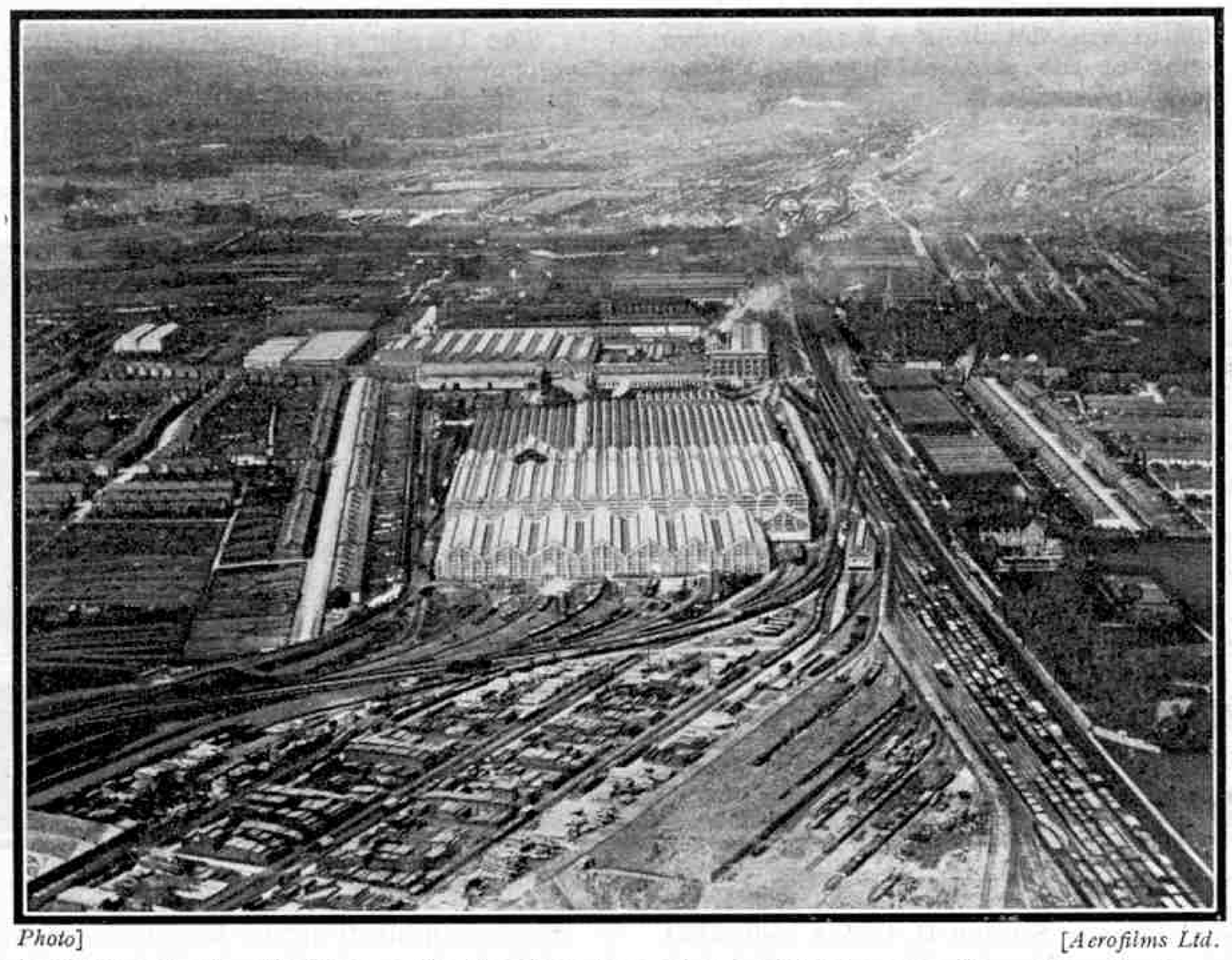
As our readers will remember, the machine was constructed by the Fairey Aviation Company for the Air Ministry, who wished to gain the world's non-stop distance record for Great Britain. It was originally announced that the machine was to fly to an unknown destination in South Africa. For various reasons however, it was decided that the flight should be to India, and if possible as far as Bangalore, a fortress town in Mysore. If this flight had been accomplished the existing record would have been exceeded by approximately 600 miles.

The journey was made by way of Frankfort, Vienna, Constantinople, Baghdad, Basra, Jask, and Karachi, and during the whole of the flight the pilots, Squadron-Leader A. C. Jones-Williams and Flight-Lieutenant N. H. Jenkins, experienced extremely bad weather conditions and head winds. These winds were particularly prevalent in the last section from Baghdad to Karachi, the 1,520 miles of which occupied 22 hours.

The machine flew over Karachi and was heading for Bombay and Bangalore, but unfortunately, after flying about 90 miles beyond Karachi, the pilots found that they were running short of petrol, and so were forced to turn back. The official distance flown was therefore only 4,130 miles, and the pilots thus failed by just over 320 miles to beat the existing record. It will be remembered that this was created in July last year by Major del Prete and Captain Ferrarin, who flew from Rome to Brazil on a Fiat-engined Savoia. The distance covered by these airmen was 4453.9 miles, and their flight was almost 8 hours longer than that of the British airmen.

The failure to surpass the Italians' record may definitely be attributed to the unfavourable weather encountered. Rain and snow were met in crossing Central Europe, and during the night flight across the Balkans the clouds were so dense that the ground was only visible on two occasions in five hours.

The Home of the "Castles"



Photo] [*Aerofilms Ltd.*

Swindon Works, the locomotive headquarters of the G.W.R., seen from the air, have an area of 309½ acres, 65 of which are roofed in. Normally 13,000 workpeople find employment in this vast depot

The Isacco Helicogyre

An aeoplane capable of rising vertically from the ground has long been one of the greatest desires of aviators. From time to time many inventors have put forward machines that they claimed were able to do this, but none of these machines has proved satisfactory when put to the severe test of a practical flight.

The latest machine of this type is the "*Helicogyre*," invented by an Italian engineer, Vittorio Isacco. This has a fuselage very similar to that of an ordinary aeroplane, but instead of the orthodox wings, four rotating wings are mounted above the machine. At the top of each of the four wings is fixed a propeller operated by a small engine. When these propellers are set in motion they cause the wings to rotate, and in this manner is obtained the vertical lifting power. Horizontal movement of the machine is obtained by means of an ordinary propeller and engine in the usual manner. A machine of this type is now being constructed for the Air Ministry, but at present details are not available.

* * * *

The number of aeroplanes licensed for air traffic in Germany in 1928 was 741. Of these 197 were owned by Luft Hansa, the well-known air traffic company, and 45 by smaller companies of the same type. Test establishments and flying schools between them were the possessors of 205 licensed aeroplanes, and 99 machines were the property of private owners. It is interesting to note that only 57 of the aeroplanes were multi-engined.

World's Air Routes

Brig.-Gen. P. R. C. Groves, Honorary Secretary General of the Air League of the British Empire, addressing the London Chamber of Commerce, stated that the length of the world's air routes in actual operation on 1st January, 1929, was 76,432 miles, as against approximately 54,000 miles on the corresponding date in 1928.

Of the total for 1929, Germany was operating approximately 18,000 miles, compared with 14,862 on 1st January, 1928; while France came next on the list with 12,570 miles in 1929 and 8,304 in 1928. The United States ran 12,295 miles and 8,948 miles in 1929 and 1928 respectively, while the total for England was only 1,090 in both years, although if the Cairo-Basra service were included this figure would be raised to 2,225 miles. The new London to Karachi service would bring the total to approximately 7,000 miles. The total mileage operated by European countries in 1929 was 49,272, which compared very favourably with the 35,996 miles in operation on 1st January, 1928.

The country having the lowest air route mileage was Denmark, with only 170 miles in operation both on 1st January, 1928, and the corresponding date in 1929.

* * * *

Aircraft Factory in the Argentine

A great military aircraft factory is now under construction at Cordova in the Argentine. The first and second portions have almost been completed, and work on the third section is to be commenced immediately. Unlike most factories, the Argentine establishment will not only build aircraft, but also will make airscrews and aero engines, the parts of the latter being received from abroad in the rough state and worked up in the factory. At the present moment Avro "Gosport" aircraft, Dewoitine all-metal fighting machines, and Lorraine-Dietrich engines of 450 h.p. are being built.

* * * *

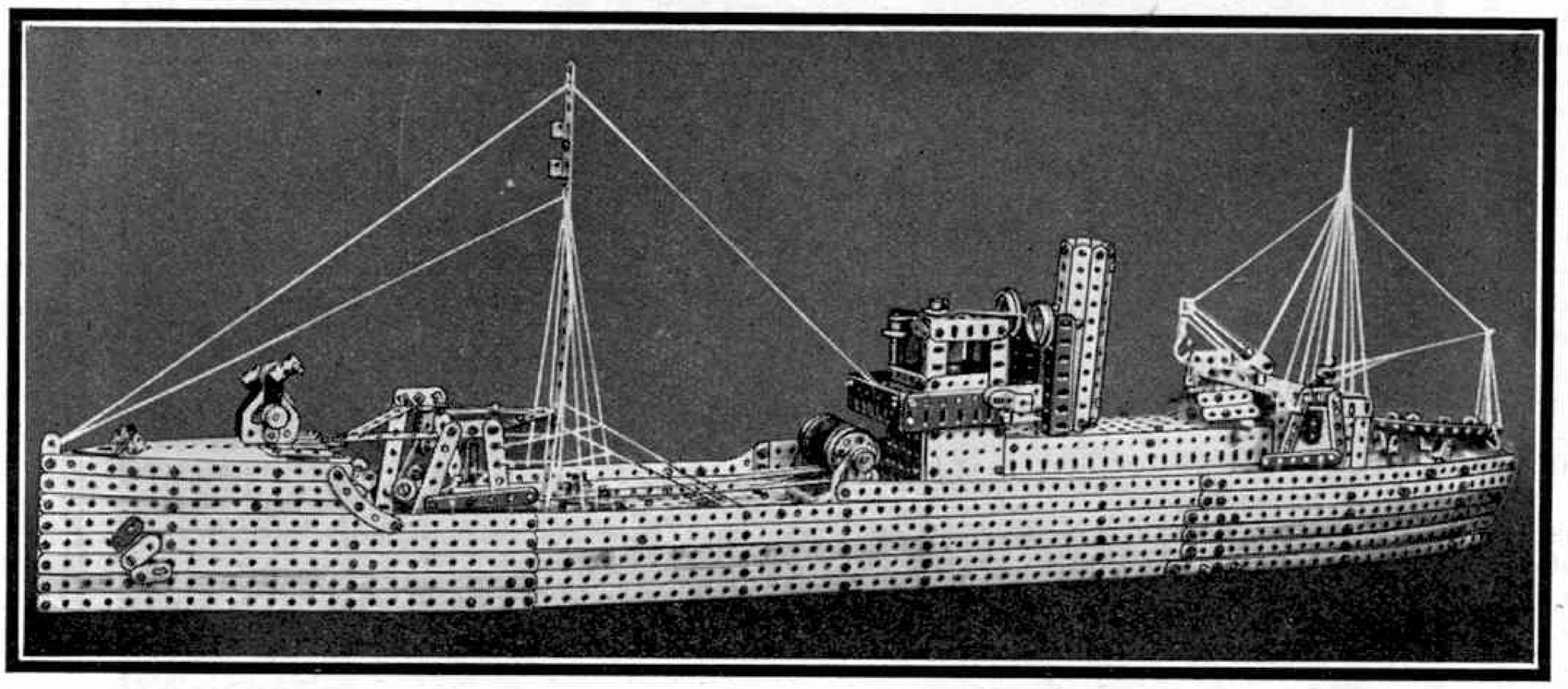
Last year 37,000 lbs. of letter mails were despatched from this country, of which nearly 20,000 lbs. were sent to Iraq by the Cairo-Basra Air Service. This is an increase of 36 per cent. over the figures for 1927. An increase also was recorded in the parcels services, the total weight for the year exceeding 100,000 lbs. for the first time.

A Further Commentary on the Results of the £100 Model-Building Competition

By Frank Hornby

Particulars of Still More Prize-winning Entries

IN my article last month I described a number of the outstanding entries in the Home Sections of the Contest, and I have pleasure in including this month, details of a further number of models that secured some of the principal awards. Even allowing for the models illustrated and described herewith, there are still a very large number that I have been unable to mention, and particulars of these will therefore appear in further special articles at an early date. Next month I hope to publish a complete list of the prize-winners in the Overseas Sections, together with illustrations of a number of the outstanding models submitted.



A graceful example of Meccano ship-building. Steam Trawler by T. M. Baskcomb (Second Prize, tie. Section B)

Illustrated at the top of this page will be seen a remarkably faithful model of the Steam Trawler built by T. M. Baskcomb (Second Prize, tie, Section B). It is interesting to note that E. Roberts, who was also one of those who shared the Second Prize in Section B, took a somewhat similar subject for his model, namely a Coasting Steamer. Robert's model was illustrated in my article last month and an interesting comparison between the two models can be made by noting the various types of constructional work incorporated in each.

The construction of the hull of the Trawler is a feature worthy of attention, the graceful appearance of this portion of the vessel being particularly marked. Baskcomb adopted the excellent plan of omitting the lower part of the hull, so that the model, when placed upon a table, has the appearance of being "well-down in the water." The inclusion of a number of deck fittings is another point that has helped to increase the realism of the complete model. A small windlass for raising and lowering the anchor will be seen mounted near the prow of the boat, while the large trawl winch for hauling and paying out the trawl net is placed directly behind it. The trawler is mounted on four Flanged Wheels, the rear pair acting as "steering wheels." A small navigating wheel represented by a Bush Wheel in the wheelhouse on the bridge is connected by Bevel Gearing to a vertical shaft on the lower end of which a Double Arm Crank is secured. Lengths of Sprocket Chain are connected to the arms of this Crank, and also to the ends of a Double Angle Strip that carries the rear wheel axle. By rotating the Bush Wheel in the wheelhouse, the vessel is thus guided either to right or left. Both trawl and anchor winches are operated by an Electric Motor located in the centre of the hull, the power being transmitted to the winches through Sprocket gearing.

The Trawler is particularly interesting as it forms an excellent demonstration of the way in which mechanical features can be included in ship models. There is naturally a greater interest in a model fitted with mechanism, than in one whose attraction lies solely in its ornamental appearance.

A well-built model of a Gloster Goring Biplane was submitted by F. R. Higgs. A good idea of this clever model will be obtained from the three illustrations that appear at the bottom of the opposite page.

Aeroplane construction to a small scale is by no means a simple task, if the completed model is to resemble its "big brother" with a large degree of fidelity. The chief difficulty generally occurs in the formation of the fuselage, it being a difficult matter to achieve a neat and finished appearance, while at the same time producing an external contour as similar to the actual machine as possible. A glance at the illustration will show, however, that this portion of Higgs' model has been remarkably well carried out. The graceful proportions of the completed machine will be apparent from the upper of the three views of the aeroplane, whilst a feature that cannot be seen in the photos is the Clockwork Motor cleverly concealed in the lower portion of the fuselage. The Motor is coupled to the propeller shaft through a Universal Joint and Bevel Gearing. In the left-hand view of the machine, the Motor has evidently been set in motion as little can be seen of the propeller! Other interesting features are, the reproduction of the radial engine, with "cylinder heads" consisting of Pinions, a Lewis gun mounted just between the main top plane, and shock absorbers fitted to the undercarriage.



Prize-winners in the £100 Contest

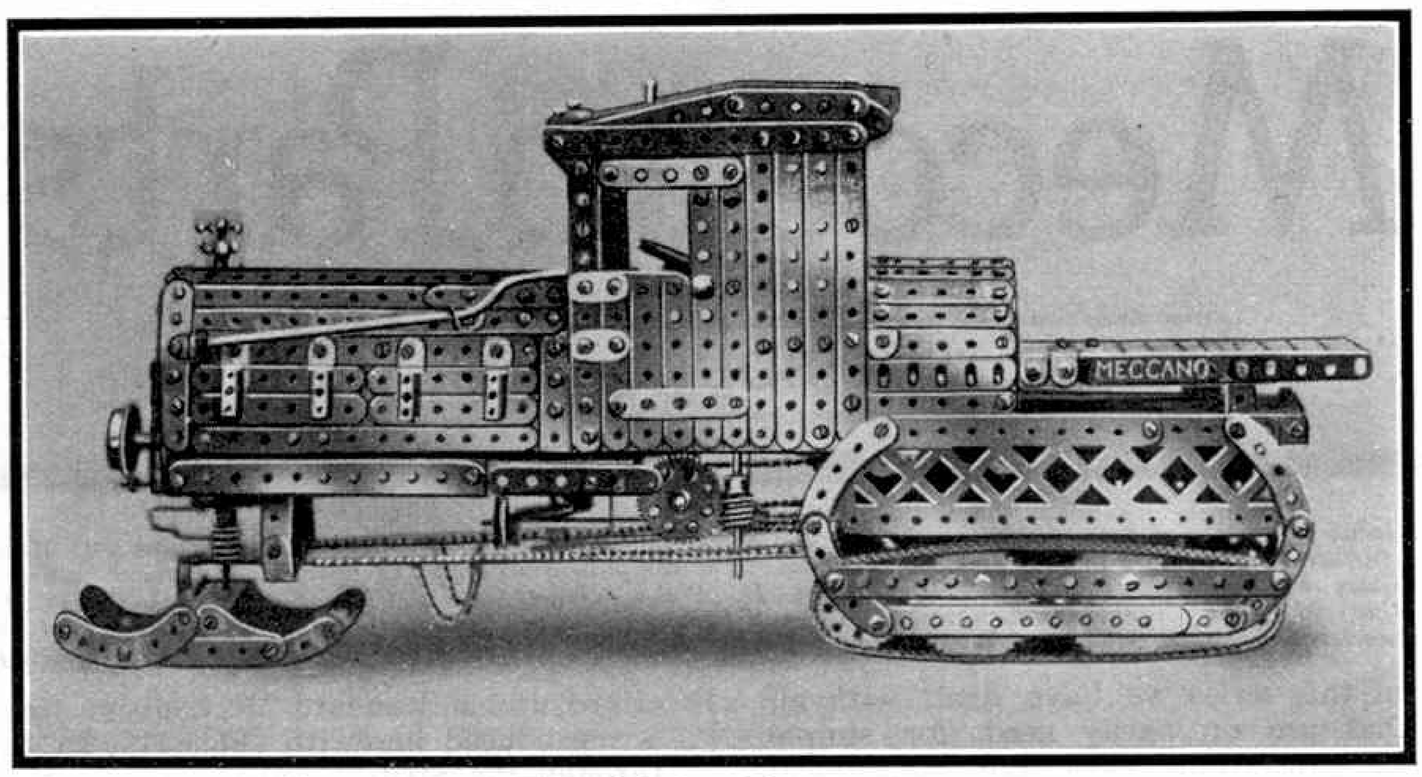
1. C. P. Plantin (2nd, tie. Sec. A). 2. F. R. Higgs (2nd, tie. Sec. B). 3. Graham Hawes (3rd, tie. Sec. C). 4. R. J. Banks (3rd, tie. Sec. A)

The introduction of caterpillar track to transport engineering is of comparatively recent date. This form of track was perfected during the War in the tanks and armoured cars that were produced during that period. During the last few years, the caterpillar principle has been applied to a large variety of other machines with excellent results—draglines, bucket excavators, farm tractors, trench diggers, comprising but a few of the many instances where this means of propulsion can be utilised.

The advantages of caterpillar track perhaps are shown most

clearly in the farm tractor, as when equipped with this mechanism a petrol-driven tractor of quite small power is capable of negotiating the roughest farm land where a machine fitted with rubber tyred wheels could not possibly move.

A particularly novel and well built model of a logging tractor employing caterpillar track was entered by J. A. Rodriguez and shared the First Prize in Section C, the model being illustrated herewith. The actual machine is employed in the Canadian lumber fields for hauling logs, after they have been felled, to the streams and rivers on which they are floated down to the saw mills. In performing this task, the tractor has often to travel over snow and ice, and in place of front wheels, a pair of 'sleds' are therefore fitted.



This original model represents a Logging Tractor. It is the work of J. A. Rodriguez (First Prize, tie. Sec. C)

The track in the Meccano model consists of a length of Sprocket Chain passed round two Sprocket Wheels mounted in a rigid framework, the drive from the Clockwork Motor being transmitted to these Wheels through worm gearing. The large Sprockets placed in between these Wheels are free on their Axles, while the Axles can slide vertically in their bearings, but are normally held in position by means of Compression Springs. This mechanism keeps the track always taut, at the same time allowing it to adjust itself to the contour of the ground. In this way the track makes firm contact with the surface over which it is travelling.

A novel feature is the position in which the Clockwork Motor has been placed. This has been built in to the top of the cab and its winding spindle can be seen projecting above this in the illustration. The Motor is thus readily accessible for winding purposes, which would not be the case if it were placed under the bonnet of the tractor. An even better position for the Motor in the model would be, however, directly above the caterpillar drive, where it could do duty as part of the rear platform.

A further ingenious feature in this interesting model is the steering mechanism. This consists of a length of Sprocket Chain whose ends are fastened to the front sleds. The Chain passes round Sprockets and rollers placed beneath the centre of the machine, these being arranged so that when the sled is turned to either the right or left, the corresponding caterpillar is disengaged from the main drive, thus facilitating steering.

Although the Contest provided examples of practically every type of machine and structure known to engineering, I was somewhat surprised by the almost complete absence of model bridges amongst such a great variety of entries.

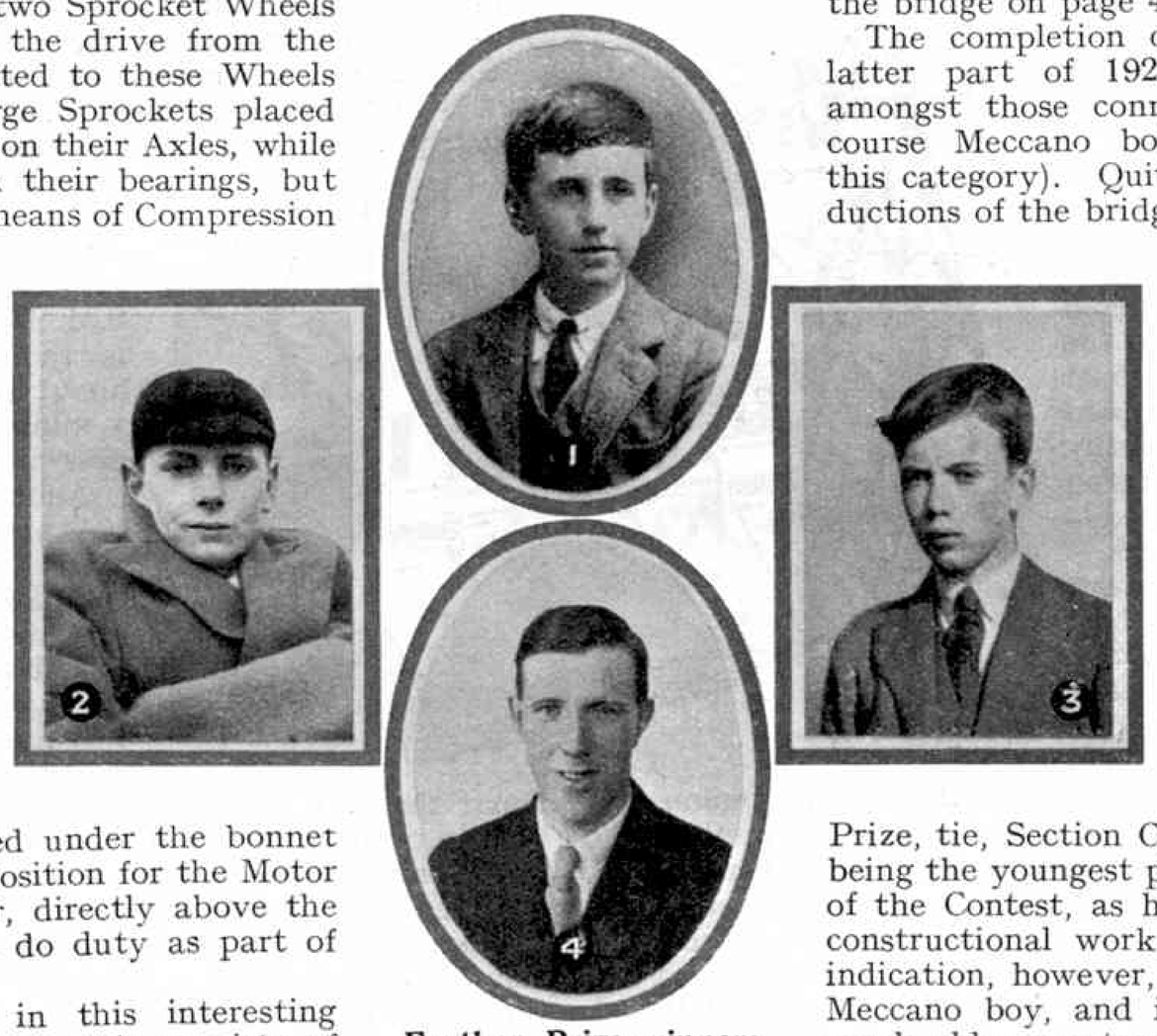
The construction of various types of bridges in Meccano is one of the most interesting tasks the constructor can undertake. Careful comparison and tests will tell him much regarding the stresses and strains that are set up in the actual structures, whilst the building of the more unusual types of bridges, such as the swing, transporter, bascule, and jack-knife patterns, provides an excellent means whereby he may express his originality and mechanical skill. Amongst the example of bridges submitted, a model of the new arch bridge over the River Tyne at Newcastle, built by E. P. Hicks (Second Prize, tie, Section C) was particularly outstanding. Some idea of its fine appearance will be gained by glancing at the illustration of the bridge on page 472 of this issue.

The completion of the actual bridge during the latter part of 1928 aroused considerable interest amongst those connected with engineering (and of course Meccano boys must not be omitted from this category). Quite a number of interesting reproductions of the bridge have since been constructed by model-builders, but Hicks' model is certainly the finest that has so far been brought to my notice.

The building of the main piers is a feature of particular note. Braced Girders and $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates have been used with excellent effect in these portions of the structure, whilst the construction of the arch girders and suspension members has been no less well carried out.

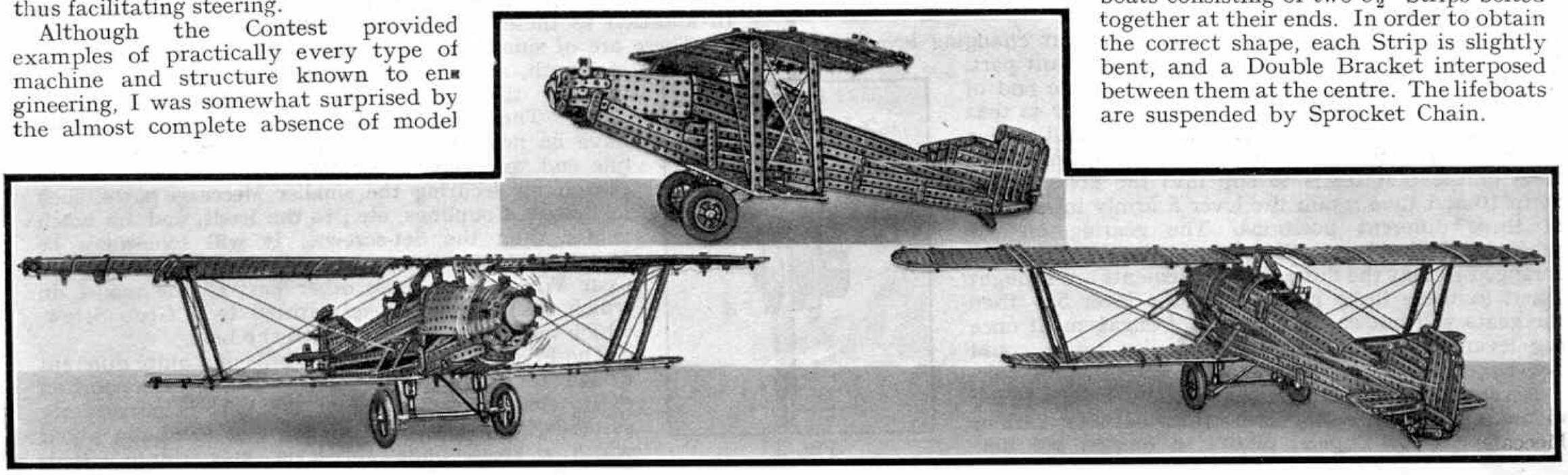
An excellent model of a battle-cruiser was submitted by Graham Hawes (Third Prize, tie, Section C). Hawes has the distinction of being the youngest prize-winner in the Home Sections of the Contest, as he is only six years of age! The constructional work in the model cruiser gives no indication, however, that it was built by so young a Meccano boy, and it would have done credit to a much older constructor.

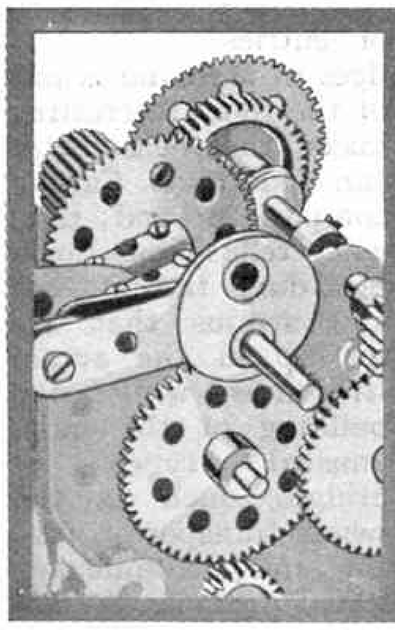
The hull of the vessel, composed of Braced Girders, is fitted with several formidable-looking guns, each consisting of Axle Rods secured to a swivelling framework and fitted with large Sprocket Wheels that form excellent gun shields! Four minute lifeboats are included in this original little model, the boats consisting of two $3\frac{1}{2}''$ Strips bolted together at their ends. In order to obtain the correct shape, each Strip is slightly bent, and a Double Bracket interposed between them at the centre. The lifeboats are suspended by Sprocket Chain.



Further Prize-winners

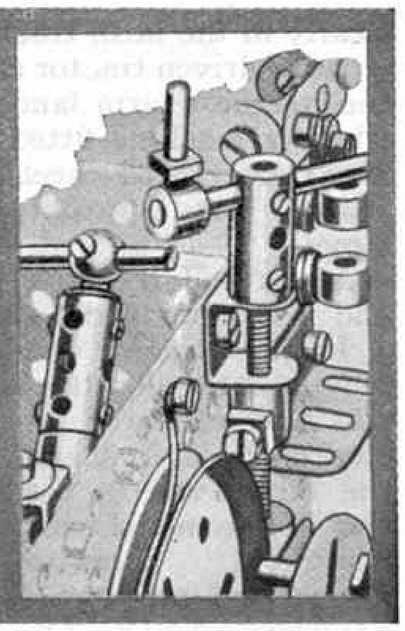
1. R. F. Harris (1st, tie. Sec. C). 2. A. M. Johnston (1st, tie. Sec. B). 3. R. W. Nash (3rd, tie. Sec. B). 4. A. T. Locke (1st, tie. Sec. A). (Below) Two-seater Biplane built by F. R. Higgs





HOW TO USE Meccano Parts

V.—NUTS & BOLTS, etc. (CLASS E)



For the purpose of this series of articles we have grouped all the Meccano parts into two main sections, termed the Structural and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping is as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools and Literature. Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical Parts; Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

IN the preceding articles in this series we have dealt with all those Meccano parts that are ordinarily used for simple structural work. Before proceeding with the Mechanical Section it will be advisable to refer to certain Meccano accessories that are indispensable for all kinds of Meccano model-building, namely, Nuts and Bolts, Screwdrivers, and Spanners. For convenience these parts have been grouped, together with the Meccano literature and other miscellaneous items, under Class E in the Structural Section.

Nuts and Bolts

Nuts and bolts are naturally amongst the most important of the Meccano accessories. When it is remembered that those that fall into the hands of the really industrious Meccano boy must withstand the strain of being screwed up tightly and unscrewed literally hundreds of times, it is not surprising that they should be carefully turned—not stamped—from the finest steel.

Quite a number of Meccano boys have written to enquire which is the best method of securing nuts and bolts—whether with the nuts or the bolt heads towards the outer side of the model. By far the greater majority of Meccano boys place the bolts with the heads outside, and this, in our opinion, is the better plan, for the Screwdriver forms a speedier method of tightening the nuts and bolts than the Spanner. Also, a model having all the bolt heads on the outer side will have a much neater appearance than one in which the nuts and shanks are all exposed.

For ordinary model building, sufficient rigidity can be obtained by using the Screwdriver only, merely steadying the nut with the fingers, but wherever excessive strain is expected, both Spanner and Screwdriver should be used simultaneously, the nut being held immovable by the Spanner in one hand while the bolt is turned by the Screwdriver in the other hand.

Until quite recently the heads of Meccano bolts were cylindrical in shape, but they are now rounded. This is a great improvement, for not only is a much neater appearance obtained in a model constructed with the new bolts, but the improved shape increases their adaptability to an important extent.

For example, Fig. 1 shows a Meccano gear changing lever in which a single bolt plays a novel and important part. The lever 5 is spaced by Washers 8 from the end of the Double Angle Strip that forms its bearing so that the bolt 9 presses firmly against a $2\frac{1}{2}$" small radius Curved Strip 10, which forms the quadrant. The head of the bolt tends to slip into the holes in the Strip 10 and thus retain the lever 5 firmly in any one of three different positions. The gearing on the shaft 3, which is controlled by the lever, should be arranged so that the different engagements are brought about in these three positions of the lever 5; then the gears will not easily ride out of engagement once the lever has been moved. A similar result could not be obtained, of course, with an old-style bolt.

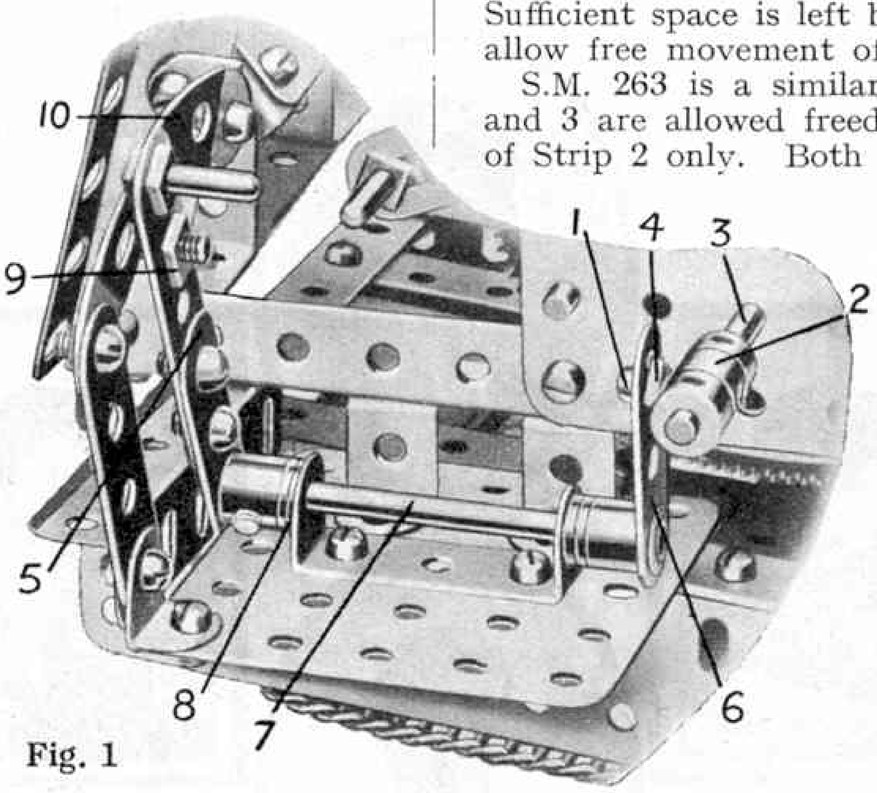


Fig. 1

A very important use of the nut and bolt is found in the making of pivotal connections between various Meccano parts. Typical pivots so formed are described under Standard Mechanisms Nos. 262 and 263. S.M. 262 is reproduced herewith (Fig. 2). In this case the bolt 1 passes through the Strip 2 and is securely held to Strip 3 by means of two nuts 4 and 5, which are screwed tight against opposite sides of the Strip. If possible two Spanners should be used so that the nuts can be turned simultaneously and in opposite directions. Sufficient space is left between the nut 5 and the bolt head to allow free movement of the Strip 2.

S.M. 263 is a similar arrangement except that both Strips 2 and 3 are allowed freedom of movement about the bolt instead of Strip 2 only. Both Strips are first placed on the bolt 1 and the nuts 4 and 5 are then placed together on its shank. The nuts are turned in opposite directions until they securely grip each other in position on the bolt. S.M. 262 is to be preferred wherever it is required to move only one Strip about the bolt, for this method affords a minimum amount of " play " or slackness in the joint.

Another kind of pivot formed from a bolt and nut is included in Fig. 1. Bolt 1 in this illustration passes through the end hole of a Crank 6 and enters the threaded bore of a Collar 2, without touching the Rod 3. It is secured rigidly in this position by locking a nut 4 against the Collar. Sufficient freedom is allowed for the Crank 6 to turn easily about the bolt, and the Collar 2, which is free on the shaft 3, is held in position by two further Collars. By means of this pivotal connection, easy longitudinal movement of the Rod 3 is obtained on operation of the Crank 6.

There are four different sizes of Meccano bolts, i.e., $\frac{3}{4}$", $\frac{1}{2}$", $\frac{3}{8}$", and 7/32" (parts Nos. 111, 111a, 111c, and 37b respectively) but the pitch of the thread is the same in every case (32 threads to the inch). This pitch is, of course, standard throughout the Meccano system, with the exception of the 6 B.A. Bolts and other special electrical accessories which will be dealt with under Class T.

The 7/32" Bolt may be obtained separately (under part No. 37b) or complete with nut (under part No. 37). It is this size of bolt that is supplied in considerable quantities, complete with nuts in all the Meccano Outfits. The other three kinds of bolts are for use in special cases where an extra long shank is required.

In addition to these bolts there are the Set-screws (part No. 69). These are of similar shape to the bolts but are only 3/16" in length, and are, of course, designed primarily for securing the various Meccano wheels to the Axle Rods. The Grub Screws (parts Nos. 69a and 69b) have no head at all, a slot merely being cut across one end to receive the Screwdriver. These are employed for securing the smaller Meccano parts, such as Collars, Couplings, etc., to the Rods, and are much neater than the Set-screws. It will sometimes be found that the Set-screw of a Meccano Pulley or Gear Wheel fouls some other part of the model, in which case it may be substituted by a Grub Screw, which will fit almost flush with the boss.

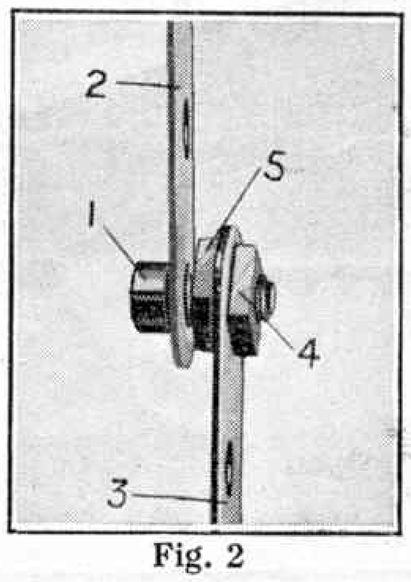


Fig. 2

The Pivot Bolt (part No. 147b) is of a quite different design to the ordinary bolts. The greater portion of its shank is smooth and the part is particularly suitable for use as a small pivot or fixed pin about which a small pulley or lever may rotate. It is

secured in position by clamping the two nuts on its shank to a Meccano Strip or other part, as in Fig. 2.

Wood Screws are also included in the Meccano system. These are, of course, for the benefit of those boys who wish to secure their models to wooden bases. They are supplied in ½" length only. Any model that does not travel will be improved in appearance and operation if it is screwed down to a wooden base.

The Meccano Tools

It is one of the great advantages of the Meccano system that the only tools required for ordinary model-building are a spanner and a screwdriver. Parts Nos. 34 and 36 are the tools that are found in every Meccano Outfit, and are the only essential ones. There are one or two other tools, however, which the model-builder finds invaluable.

The Box Spanner (part No. 34b) has a kind of slot at each end into which the nut may be slipped. With the aid of this tool a nut may be placed in positions where it would be impossible to reach with the fingers.

The Extra Long Screwdriver (No. 36a) is of similar pattern to part No. 36, but the blade is 5" long instead of 3½", and instead of the end being flattened slightly as shown in the accompanying illustration it is of the same diameter as the shaft. This enables the shaft to be passed completely through the standard Meccano holes. This is a very valuable feature and enables one to reach bolts placed in the most awkward positions.

The Special Screwdriver is also illustrated. It is all-metal and measures 8" in overall length. Like part No. 36a the blade of this tool is of such a diameter that it may be passed through standard Meccano holes.

Another Meccano tool that we illustrate is the Reed Hook (No. 105). This is designed to facilitate the threading of the warp threads through the Meccano Loom. The tool is not indispensable but those boys who have tried passing the threads one by one through the eyes of the healds and through the reed frame will find it a great boon.

Useful Lubricating Accessories

Other accessories that may be classified with tools and which must not be omitted are the special Meccano Oil Cans. There are two designs, No. 1 (ordinary type) and No. 2 ("K" type). The latter is reproduced herewith and Meccano boys will note that besides forming a very efficient lubricator it is also a very clever reproduction in miniature of a famous type of oil can largely used by engineers. The oil may be ejected drop by drop by depressing the valve, as in the full size model. The No. 2 Oil Can measures 5" in overall length and is probably the smallest of its type ever manufactured for practical use. One of the Meccano "K" type oil cans was recently sent to H.R.H. the Prince of Wales and a gracious letter of acknowledgment was received expressing H.R.H.'s admiration of the beautiful lines and perfect finish of the model.

It is very important to remember that, like actual machinery, Meccano models must be kept well lubricated. This is specially important where gearing of any kind is concerned. The teeth of the gears should be kept always moist, as should all journal bearings, pivots, etc. A specially prepared lubricating oil is included in the Meccano system and may be obtained in small bottles. This oil is particularly suitable for lubricating Meccano Clockwork and Electric Motors.

Another important accessory included in this Class is the Meccano Enamel. As every "*M.M.*" reader will know, nearly all Meccano parts may now be obtained enamelled in colours, and for the benefit of those boys who wish to convert nickelled parts to coloured ones, or to touch up coloured parts should such treatment become necessary through mishandling or excessive wear, the Meccano Enamel is supplied in small tins. There are three colours available, red, grey, and green, each colour being identical in shade with the enamel used in the Meccano factory for spraying Meccano parts. The enamel should be applied with a small brush, the surface of the part having first been cleaned thoroughly with fine emery cloth. When quite dry the enamel gives a splendid finish to the Meccano parts.

The Meccano Literature

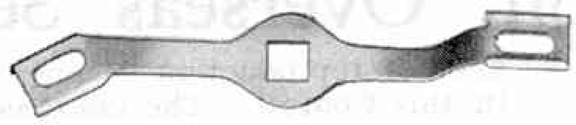
The greatest thrill of Meccano model-building is to be derived from building according to one's own ideas, but before a Meccano boy attempts to do this he should make a point of building all the models shown in the Meccano Instructional Manuals that are within the range of his Outfit. By doing so he obtains that familiarity with the Meccano parts and their uses which is essential for successful "inventing." A very large selection of models is included in the Instruction Manuals. They are arranged according to the Outfits with which they may be built, so that the boy who starts at the beginning of his Manual and goes on building each example shown, will find his models growing ever more complicated and interesting.

Instructions are included wherever the illustrations are not sufficiently clear, but for the rest the Meccano boy is expected to use his own eyes and ingenuity! After a little practice it is surprising how easy it becomes to build the most elaborate model from quite a small illustration. It should be remembered that wherever there is any doubt about the size or position of any part in a model, the necessary information can easily be obtained by counting the holes in adjacent Strips.

Some of the models included in the Manuals require so many illustrations in order to show each detail clearly that they would occupy several pages. Such models therefore are dealt with in special instruction leaflets, which are beautifully printed and profusely illustrated from actual photographs. These leaflets are included in the Outfits with which the respective models can be built, and they may also be obtained separately.

The Meccano Standard Mechanisms Manual is designed for the use of the more advanced model-builder. Its object is to provide ready reference to a large number of Meccano movements that are to a large extent standardised, in that they may be applied to more than one model with very little alteration. (*Cont. on page 505*)

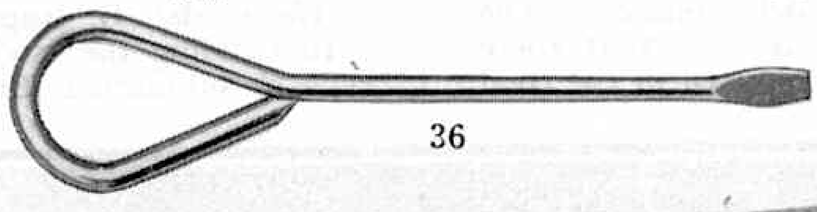
Parts in Class E: Nuts and Bolts, Tools, and Literature



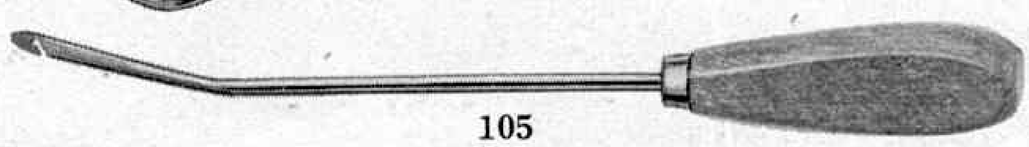
34b



34



36



105

Nuts and Bolts

Part No.			Prices s.	d.
37	Nuts and Bolts, 7/32"	per box (doz.)	0	6
37a	Nuts	" "	0	3
37b	Bolts, 7/32" ...	" "	0	3
68	Woodscrews, ½" ...	doz.	0	3
69	Set Screws	"	0	3

Part No.			Prices s.	d.
69a	Grub Screws, 5/32" ...	doz.	0	4
69b	" " 7/32" ...	"	0	5
111	Bolts, ¾" ...	... 2 for	0	1
111a	" ½" ...	... 3 "	0	1
111c	" ⅜" ...	... doz.	0	3
147b	Pivot Bolt with 2 nuts	each	0	2

Tools, etc.

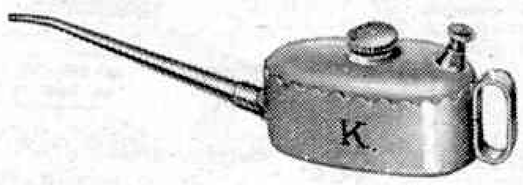
34	Spanners	each	0	2
34b	Box Spanners ...	"	0	4
36	Screwdrivers	"	0	3
36a	" extra long	"	0	6
36b	Special Screwdrivers	"	1	0
105	Reed Hooks, for looms	"	0	4

	Oil Can No. 1 (ordinary type)	each	0	6
	Oil Can No. 2 ("K" type)	"	3	6
	Meccano Lubricating Oil	per bottle	0	6
	Meccano Enamel (red, grey, or green)	per tin	0	8

Literature

56	Instruction Manuals for Outfits Nos. 4-7	each	1	6
56a	Instruction Manuals, for Outfits Nos. 00–3	"	1	6
56b	Instruction Manuals, for Outfit No. 0 ...	"	0	4
56c	Meccano Standard Mechanisms Manual	each	1	0
56d	Meccano Book of New Models	"	0	6
56f	Meccano Bound Manual	"	7	6

For particulars of the Meccano Super Model Instruction Leaflets, please write to Meccano Ltd., Binns Road, Old Swan, Liverpool, for illustrated price list.



This is an illustration of the Meccano Oil Can No. 2 ("K" type). As will be seen it is complete with filler with screwed cap and a spring plunger or valve. By depressing the latter the oil is ejected drop by drop.



The Meccano special Screwdriver (part No. 36b) is a strong and useful tool. It is all metal and the shaft is fitted to the handle in such a manner that it is impossible for one to slip round without the other.

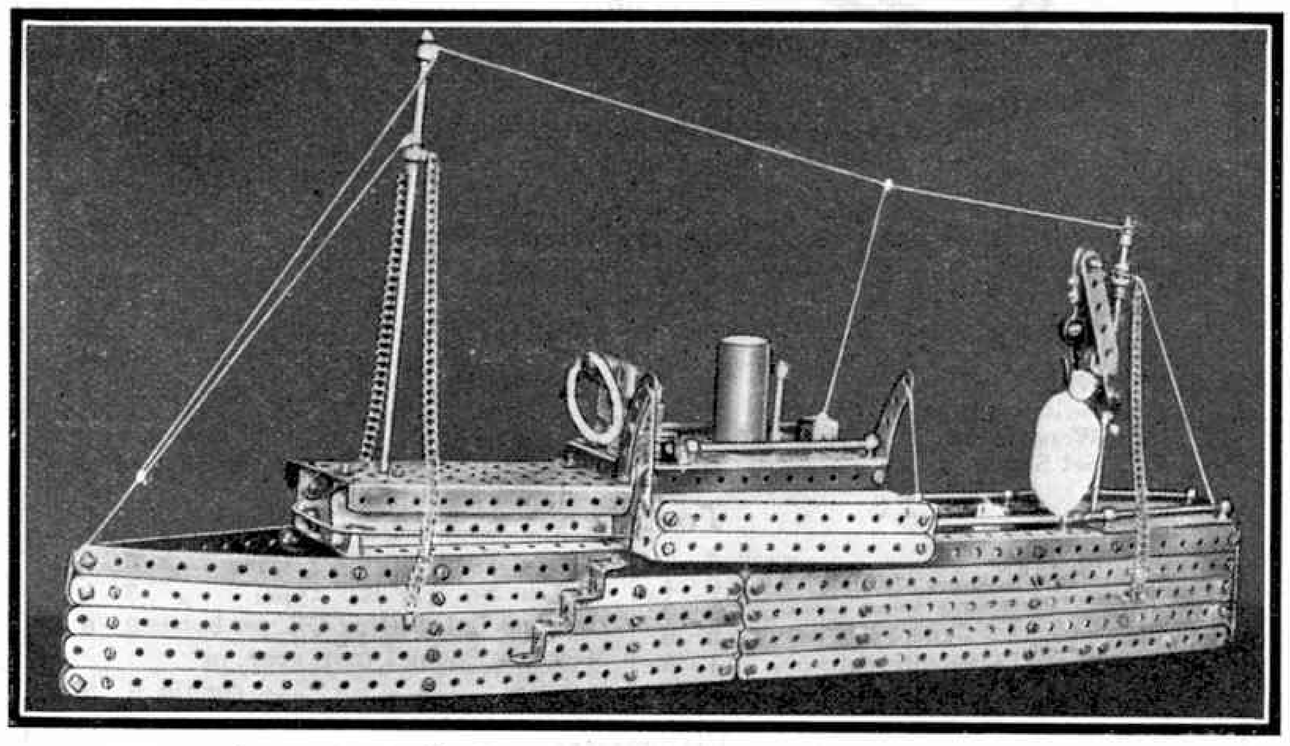
Results of Meccano Model-Building Contests

By Frank Hornby

"September" Competition, Overseas Section

JUDGING the Overseas Section of one of the model-building Competitions is always an interesting task, for it provides a means of comparing the rival merits of Meccano boys at home and abroad at the great game of model-building! The Competitions generally show, I am pleased to say, that there is very little to choose between the models submitted in the rival Sections, but this does not mean that the entries will always be of equal excellence. The concentrated efforts of either Home or Overseas model-builders might completely change the present state of affairs. Every individual competitor should therefore make a special effort when entering future contests with a view to improving or at least maintaining the standard in his Section.

The models submitted by overseas readers in the September Contest were outstanding for their originality, as the illustrations on this and the accompanying page show, and, in addition, the constructional details have been carried out with great care. The prizes have been awarded as follows:



A neatly built Steamship submitted by G. Morgan

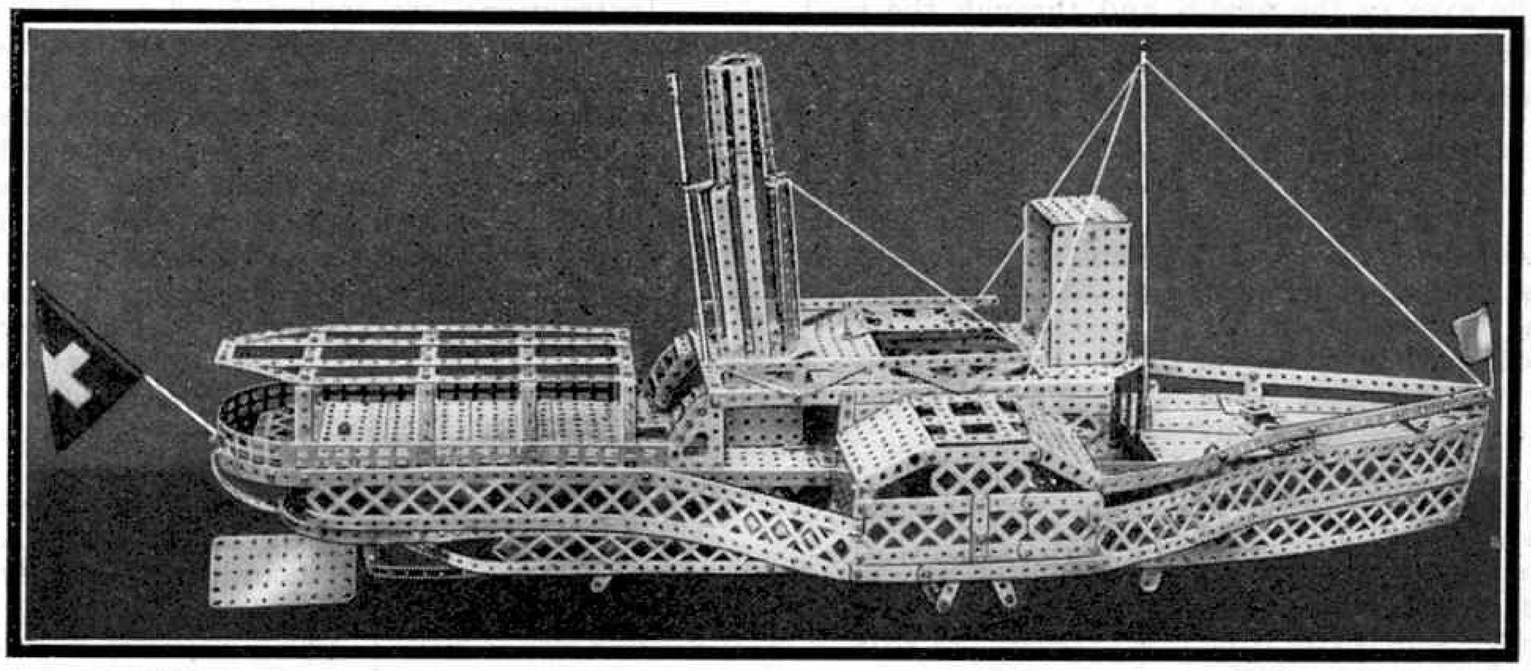
Section C (Overseas Competitors)

FIRST PRIZE (cheque to value £3-3s.): G. Rappini, Rome, Italy. SECOND PRIZE (cheque to value £2-2s.): J. J. Canela, Barcelona, Spain. THIRD PRIZE (Tie, each entry will be awarded a cheque to the value of £1-1s.): Theo Mader and Walter Grimm, Biel, Switzerland, Ernst Hochuli, Biel, Switzerland.

SIX PRIZES each consisting of Meccano Double Headphones: L. Pedrali, Brescia Italy; Gay Holthouse, Westbrook, Queensland, Australia; Ken Angus, Napier, New Zealand; R. Brenni, Mendrisio, Switzerland; G. F. Morgan, Wellington, New Zealand; G. R. Cartledge, Mayville, Durban, S. Africa.

TWELVE PRIZES, each consisting of Meccano Single Headphones: T. C. Walker Westmount, Canada; Terence W. Moore, New York, U.S.A.; Kenneth Orams, Blenheim, New Zealand; Donald Anderson, Pueblo, Colorado, U.S.A.; Edwin Worthington, Vancouver, B.C.; Nelson Eustis, Alberton, Australia; P. Woodman, Puerto de la Cruz, Tenerife, Canary Isles; A. W. Crabtree, Napier, New Zealand; D. Barron, Wellington, New Zealand; S. F. Desai, Navsari, India; Frederick G. Glass, E.de Pernambuco, Brazil; F. R. Carr, Sydney.

SPECIALLY COMMENDED, Certificate of Merit and Standard Mechanism Manual: D. Dugmore, Fort Beaufort, South Africa; H. G. Wilson, Rosewood, Queensland; C. B. M. McBurney, Glion S/Montreux, Switzerland; E. Smith, Rosemount, Montreal, Que., Canada; N. B. Scot, Winnipeg, Canada; R. O. Jukes, Christchurch, New Zealand.



This realistic Paddle Steamer is the joint work of T. Mader and W. Grimm

Readers will probably remember that details of a novel Meccano model, a submarine, submitted by a Meccano boy from Cairo were published some time ago in these pages. At the time I commented upon the originality of the subject chosen by this constructor, and I was therefore particularly pleased to find another reproduction of one of these under-water craft entered in this Contest. The construction of this last-mentioned model has been so well carried out that I decided to award the builder of the model, G. Rappini, a young Italian boy, the first prize.

In building the model, which is representative of the Holland type of submarine, Rappini was particularly careful to see that every detail that could be reproduced in Meccano, was included, and his efforts have been highly successful. The controls have been arranged in the model, so that by manipulating levers in the "control cabin" situated directly below the conning tower, the various "elevators" and the rudder can be deflected at will, or the propellers started and stopped, a Clockwork Motor secured to the framework of the model being used to drive these.

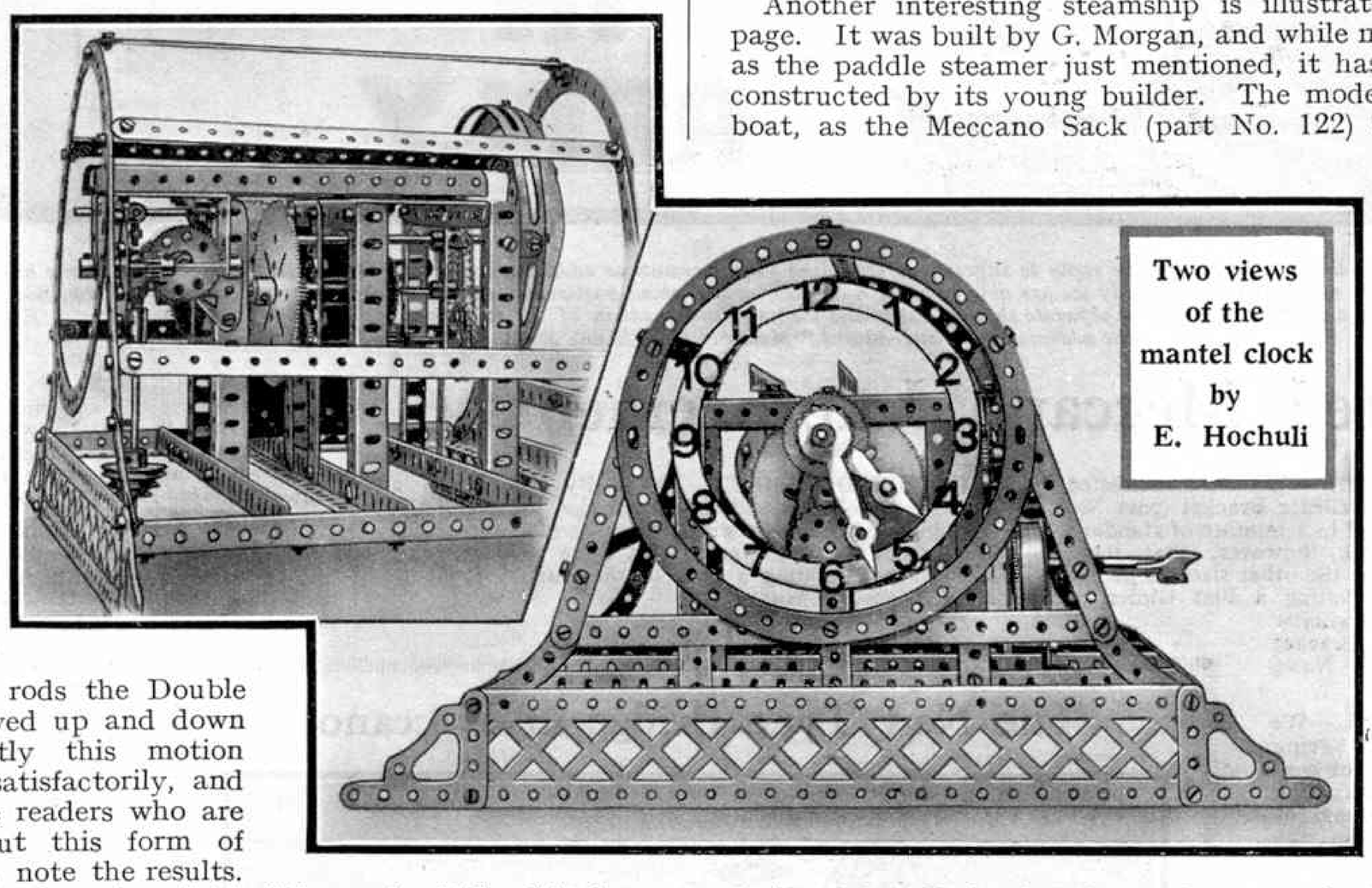
The principal disadvantage in building model submarines is that they cannot, of course, be made to "work," and this is probably the reason why they have not been more popular with constructors in the past. If all the essential features are carefully reproduced, however, a model submarine can be made very interesting, and will be remarkably useful at a "How it Works" demonstration. Many interesting details regarding the various forms of submarine will be found in the series of articles on the subject that appeared in the Magazine for July, August and October last year.

The second prize in this Contest was awarded to J. J. Canela of Barcelona for his model loom. The model is of particularly clever design, in that while turning out material that in many respects is identical to the cloth produced by the Meccano Loom, it is approximately half the size of the latter machine!

The way in which Canela has condensed the various mechanisms of a loom into so small a space is a matter of great wonder, but the resulting model is quite soundly designed and certainly does what it is required to do—the best testimonial for any mechanism! A portion of the construction of the model with which I do not altogether agree is the use of disc cams built up from sheet metal. These cams operate levers that alternately raise and lower the heald frames, but Meccano Eccentrics could be employed in their place. Model-builders should, as far as possible, avoid using any parts, that are not contained in the Meccano system, for although "non-Meccano" accessories may work efficiently, their use prevents many boys from building a similar mechanism

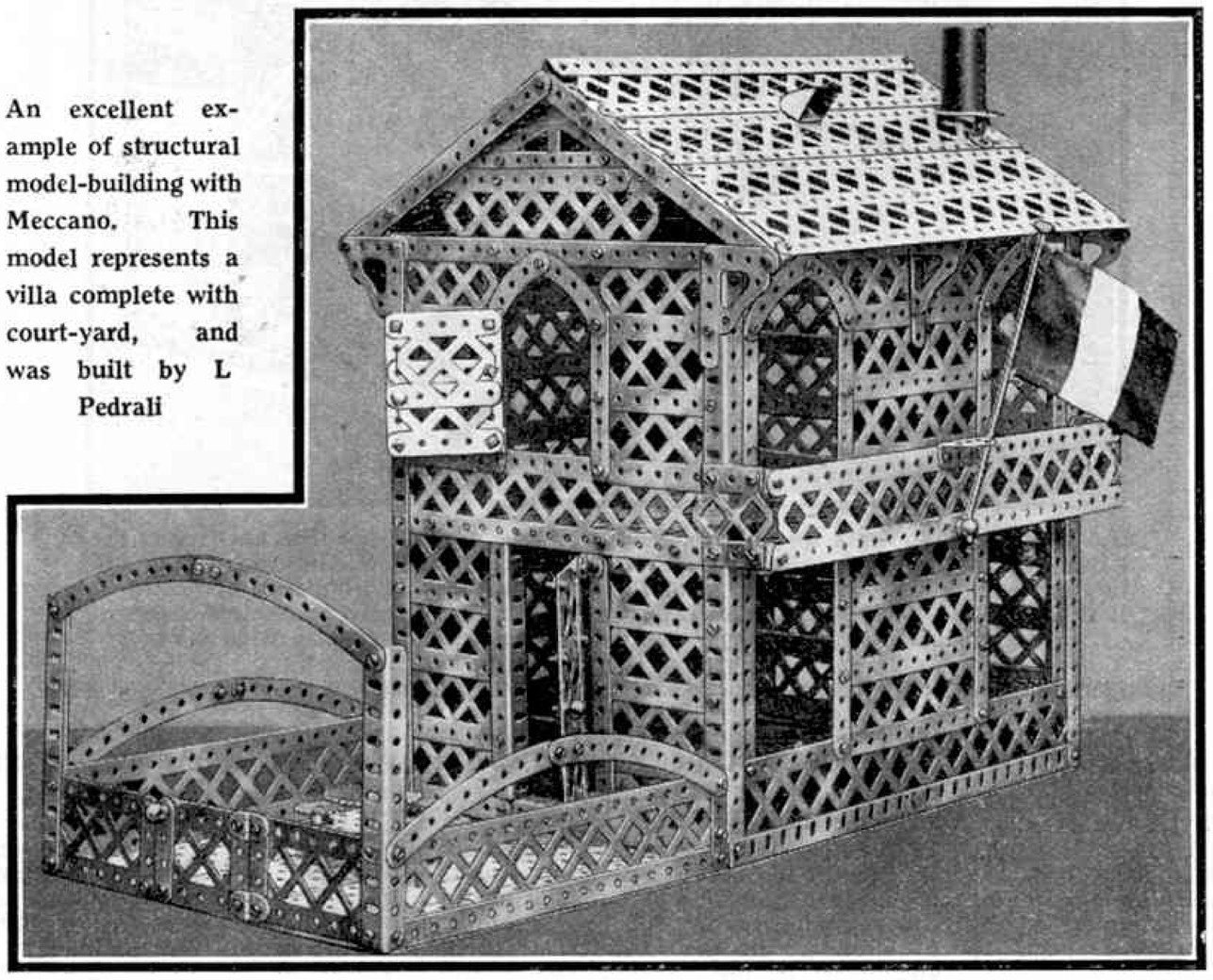
as everyone is not adept with tools, and often sheet metal, etc., cannot be obtained by the average builder.

I was particularly struck by the ingenious picking motion included in the model. The picking motion in the Meccano Loom, it will be remembered, consists of a pair of long rods, or "picking sticks," that are oscillated backwards and forwards by means of cranks and cams, the lower ends of these rods being attached to cords, which also carry Double Bent Strips that slide in each half of the slay. Canela has, however, devised a much more compact motion by dispensing with the cords and long rods. In his mechanism short rods that slide in Flat Brackets, attached to the Double Bent Strips, which in turn slide in the slay, are used, and by oscillating these rods the Double Bent Strips are moved up and down the slay. Apparently this motion functions perfectly satisfactorily, and I suggest that those readers who are able, should try out this form of picking motion and note the results.



Two views of the mantel clock by E. Hochuli

Two pleasing examples of model-building, of widely differing subjects, were tied for the Third Prize, both being illustrated on these pages. The first comprised a mantel clock and was built by E. Hochuli, and the second, a quaint paddle steamer constructed jointly by T. Mader and W. Grimm. Hochuli's model certainly upholds my statement regarding the originality of the entries in this contest, as everyone will agree that although many models of clocks of the "Grandfather" type have been devised in Meccano, a mantel time-piece built entirely from Meccano parts is of no little novelty. From the photos it will be seen that the driving power is obtained from a Meccano Clockwork Motor, while the speed at which the clock runs is controlled by a short pendulum fitted with a "bob" consisting of a Cone Pulley. The time-piece would no doubt keep accurate time over a long period. This might at first seem strange for, as every owner of a Clockwork Motor will know, the speed of the driven shaft varies according to the condition of tension of the spring. It is the constant swing of the pendulum, however, that adjusts matters and controls the spring in the Clockwork Motor so that the hands rotate at a uniform speed. The escapement mechanism employed in this model, as will be seen, differs somewhat in design from that incorporated in the Meccano Grandfather Clock, a Face Plate studded with bolts being used as a pallet wheel whilst a Collar fitted with a $\frac{3}{4}$" Bolt constitutes the pallet itself.



An excellent example of structural model-building with Meccano. This model represents a villa complete with court-yard, and was built by L Pedrali

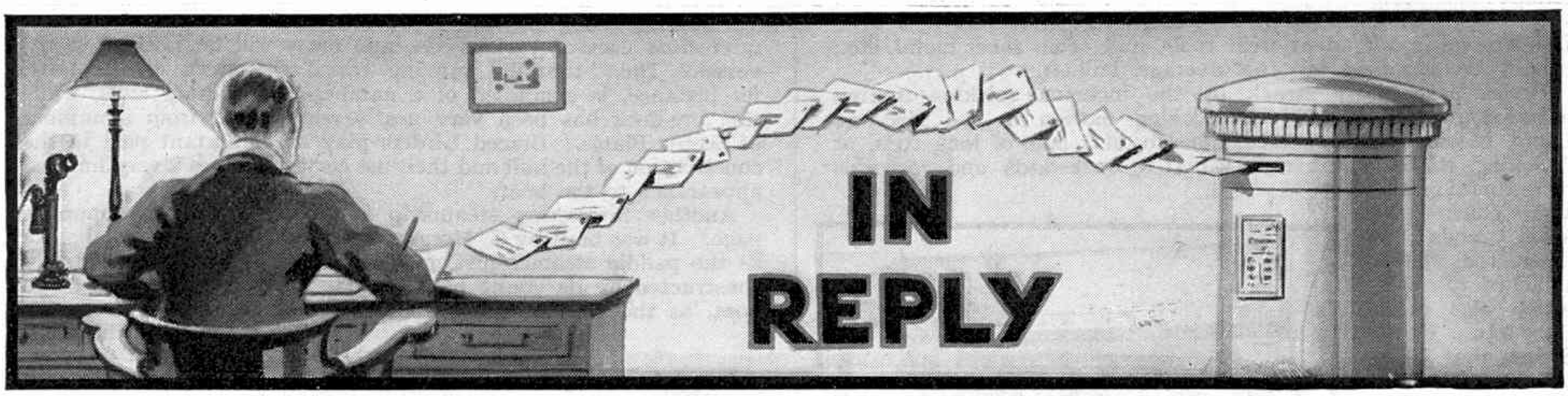
The paddle steamer built by T. Mader and W. Grimm was no less interesting. Its somewhat unusual appearance can be accounted for by the fact that its prototype has to negotiate the shallow Swiss rivers, and hence a flat-bottom "tub-shape" hull, and small paddle wheels are essential. Some very interesting uses of various Meccano parts will be noticed in the vessel. The "taffrail" running round the stern of the boat, for instance, is composed of a number of Windmill Sails, while the fore-deck has been very neatly constructed from a number of Sector Plates. Braced Girders play an important part in the construction of the hull and their use certainly gives a very finished appearance to the boat.

Another interesting steamship is illustrated on the opposite page. It was built by G. Morgan, and while not quite so elaborate as the paddle steamer just mentioned, it has been very sturdily constructed by its young builder. The model represents a cargo boat, as the Meccano Sack (part No. 122) suspended from the deck at the stern readily shows! Other items of interest on the vessel are the lifeboat suspended from davits consisting of Curved Strips, and the stairway composed of a number of Reversed Angle Brackets, which can be seen fitted to one side of the hull.

The greatest joy that model-building can offer to the constructor is, after he has carefully built up a mechanism, to see it function exactly as he has designed it. It is therefore only natural that the majority of model-builders should devote their attention to the construction of working models, but it should be remembered that Meccano is also ideal for building up models of stationery structural work. A good example of this type of construction is the model villa, shown on this page. The model, which was constructed by a young Italian Meccano boy, L. Pedrali, has a remarkably sturdy appearance, while an artistic effect has been introduced by the judicious use of Architraves and Braced Girders. Note the Dredger Bucket representing a "sky-light" in the roof!

A very ingenious motor race game was submitted by K. Angus. The model consisted essentially of a large framework built up from Angle Girders, the upper portion of the framework being divided into three separate tracks, each track carrying a miniature model automobile. To the lower end of the framework three Crank Handles were fitted and, by turning these, the players propelled the racing cars along the respective tracks towards the winning post at the top end of the framework. The way in which the miniature models were driven is remarkably ingenious. To each car a length of cord was attached, and this cord, after having been passed round a Pulley at the top of the framework was led back to a winding drum journalled near to the Crank Handle at the lower end. The Crank Handle and winding drum were coupled together by a gear train, the gearing including an "idler" Pinion attached to a centrifugal governor.

The model operates as follows. The three model racing cars are first of all placed at the starting position on the tracks, and at a given signal the players commence turning the Crank Handles. This causes the cord attached to the cars to be wound on to the drums, and the cars travel (*Continued on page 505*)



In this and the following page, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

Suggested Meccano Improvements

NEW GIRDER BRACKETS.—We were interested in your suggestion that the Girder Bracket (part No. 161) should be manufactured in a number of standard lengths. We do not think, however, that there will be sufficient demand for the other sizes to justify their introduction, as by bolting a Flat Girder to an Angle Girder a girder of similar section to the Girder Bracket results. (*Reply to R. W. Nash, Harrogate*).

NEW FLANGED WHEEL.—We agree that a flanged wheel having a diameter of 4" would be of considerable use in the construction of locomotives. As you remark, it would fill the gap between the Flanged Wheel constructed from a Face Plate and Wheel Flange, and one built up from a 6" Circular Plate and 5½" Hub Disc. We are looking into the idea of introducing this wheel. (*Reply to R. Levett, Paddock Wood*).

SPECIAL ROLLER.—A roller manufactured from stone or other heavy substance would hardly ever be used in Meccano models. We suggest that in place of a special roller you use a Boiler (part No. 160) and fill it with a quantity of lead scrap or small stones in order to make it sufficiently heavy. (*Reply to P. J. West, Oxford*).

RULE STRIP.—To engrave a standard 12½" Strip with inches and fractions of an inch would be quite a good idea, but to do this with any amount of accuracy would be an expensive procedure. The graduated scale thus formed would not, moreover, be particularly useful in the Meccano system, as the ½" equidistant spacing is employed throughout and the perforated Strips form quite useful 'rules' in themselves. We are, however, making a note of your idea for future reference. (*Reply to J. Hain, Dayton, Ohio, U.S.A.*).

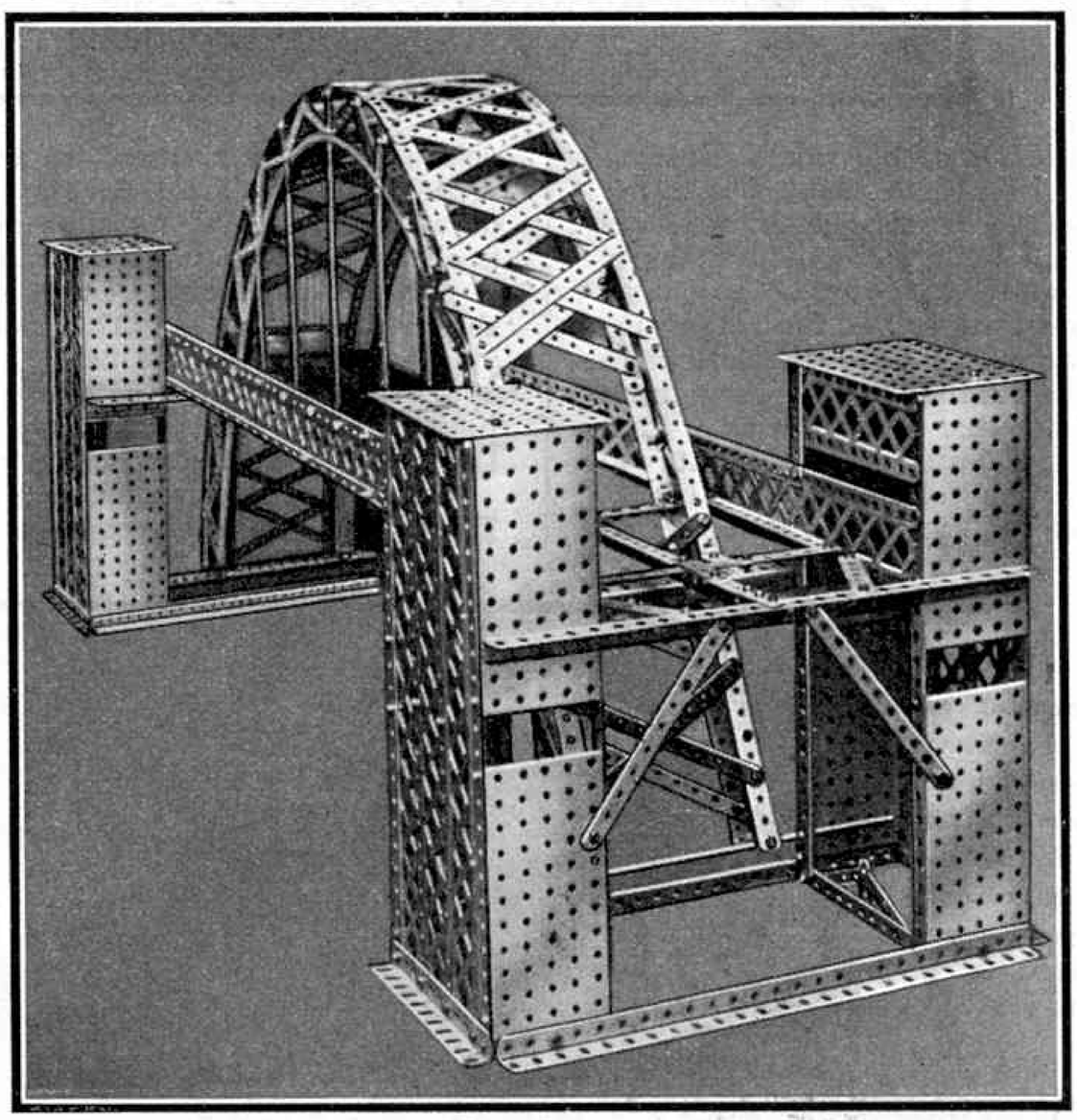
STEERING WHEEL.—We have previously mentioned that we do not intend to introduce a steering wheel, as it would be purely ornamental, and existing parts, such as the 2" Pulley Wheel, can be used in its place. Your idea for increasing the adaptability of the part by manufacturing it from ebonite or fibre is distinctly good. You point out that on account of its insulating properties such a wheel could be employed in electrical switchgear, etc., which would greatly increase the range of utility of the part. We are keeping a note of your idea. (*Reply to A. M. Tucker, Topsham*).

CATERPILLAR TRACK.—You will be interested to hear that experiments have been carried out with built-up caterpillar track composed mainly from standard Meccano parts. So far results have been very satisfactory and further details will appear in the "*M.M.*" very shortly. (*Reply to R. Polson, Toronto, Canada*).

NEW FORK PIECE.—A fork piece resembling a 2½" × ½" Double Angle Strip with a boss fitted to its centre would have few uses. It is quite a simple matter to duplicate your suggested part from existing accessories, as for example by bolting a Double Arm Crank to a Double Angle Strip. (*Reply to P. Berry Huddersfield*).

IMPROVED BOILER END.—By stamping a number of holes around the rim of the Boiler end the usefulness of this part would be materially increased. We do not think, however, that there would be any advantage in adding a boss to this part. (*Reply to H. R. Wilcock, Chingford*).

The New Tyne Bridge in Meccano



Our illustration shows a splendid model of the new arch bridge that now spans the River Tyne at Newcastle. The model was constructed by E. P. Hicks of Pelaw, and tied for Second Prize in Section C of the Grand £100 Model-building Competition. It is remarkably well designed and constructed, and effectively reproduces much of the graceful yet sturdy appearance that the actual structure possesses

IMPROVED CLOCKWORK MOTOR.—We note that you suggest fitting the Clockwork Motor with a governor of the type found on gramophones. It would be quite impossible to do this, however, while keeping the size of the Motor reasonably small. We suggest that you attempt to devise one of these governors from existing parts. Why not submit your attempt as an entry in the 'Governor' Contest that was announced in the "*M.M.*" last month? (*Reply to T. E. Whittle, Chorley*).

'HEART' CAM.—We were interested in your suggestion that a 'heart' cam should be introduced. It is doubtful whether many uses could be found for this part, but we shall keep your idea in mind. We would draw your attention to Suggestion No. 158 on page 396 of last month's "*M.M.*" (*Reply to F. R. Houghton, Birmingham*)

SHIP'S FUNNELS.—By colouring the ship funnel to represent other shipping firms in addition to the Cunard line these parts would be made additionally interesting. We are considering doing this in the near future and a definite announcement will appear later. (*Reply to J. Coldicott, Edinburgh*).

SPIRAL GEARS.—Spiral gears, if introduced to the Meccano system, would certainly be very useful. Unlike the ordinary straight tooth gear, the gear ratio resulting when two of these wheels are meshed together does not depend upon the relative diameters of the wheels but upon the pitch spiral of the teeth. It is thus possible to obtain quite high ratios between two wheels while keeping the gearing compact. These wheels would be costly to produce, however, as very complicated machinery is required in their manufacture. In addition, wheels of this type, prepared to such a small size for use with other Meccano parts, would not be as free running as the standard straight toothed spur Gears at present in the system. (*Reply to D. L. Bushell, York; G. L. Dunn, Goudhurst; and E. P. Rudkin, Grantham*).

IMPROVED PAWL.—Your idea that the small hole at present drilled in the Pawl should be enlarged so that a standard bolt could be placed in it, is quite a good idea. There are very few cases where it would be necessary to fit a bolt to the Pawl, however, and we are afraid that the weakening of the Pawl by enlarging the hole would not be counter-balanced by its increased usefulness. (*Reply to G. W. Watson, Letchworth*).

SPECIAL PENCILS.—We have received several suggestions that a special "Meccano Pencil" should be supplied for use with the Meccano Engineer's Pocket Book, but it would be hardly worth while to supply a pencil for this purpose alone. Your idea that a very thin pencil that would pass through the standard Meccano holes should be introduced is distinctly good, as a thin pencil is often required in models such as the Pantograph (see 4-7 Manual, page 6, Model No. 4.2). We are considering this idea. (*Reply to B. C. Bateman, Vaud, Switzerland*).

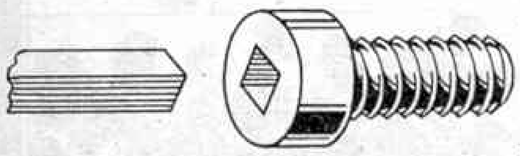
IMPROVED EYE PIECE.—By drilling the boss of the Eye Piece (part No. 50a) with a standard Meccano hole at right-angles to the tapped hole at present cut in it, the Eye Piece would certainly be improved. This idea will receive careful attention. (*Reply to B. C. Bateman, Vaud, Switzerland*).

CORRUGATED SHEETS.—Although we admit that control gear, motors, etc., of large machines such as cranes, draglines, etc., are often enclosed in corrugated sheeting, we are afraid that it would not be a practical proposition to supply special corrugated sheets for this purpose. Quite a realistic effect can at present be obtained by employing the standard Meccano Flat Plates. (*Reply to J. A. Keightley, Levenshulme, Manchester*).

PINION FOR BALL BEARING UNIT.—A special Pinion would not be suitable for use with the Ball Bearing Unit, as the teeth are intended solely for use with Sprocket Chain. If a Sprocket Wheel is compared with a Gear or Pinion, it would be noticed that the teeth are totally different in shape. (*Reply to E. Worthington, Vancouver, B.C.*).

Suggested Meccano Improvements—(*Continued*)

"NON-SLIP" SCREWDRIVER.—Your solution to the problem of preventing the screwdriver from slipping when bolts are being turned is certainly an interesting one. From the sketch it will be seen that a square slot would be cut in the heads of all bolts, and a special driver having a square section shaft would be employed to turn the bolts, etc. This arrangement would certainly prevent slipping, but it would be very awkward and inadaptable. The question also arises as to how grub screws could be manipulated if a "square-shafted" screwdriver was standard equipment. As an alternative a slot closed at both ends could be cut in the heads of bolts, etc., but we do not consider that the extra cost is worth while. By dint of practice the model-builder should become so expert with his driver that the need for a "non-slip" device would vanish! (*Reply to D. S. Bond, Ilford*).



REFLECTOR.—A reflector that could be used in conjunction with the lamp and lamp holder would form an interesting and useful addition to the system. Such models as lamp standards, hand lamps and similar devices would benefit by the introduction of a suitable reflector. We are giving careful attention to this idea. (*Reply to W. T. Turnbull, Kinsella, Alberta, Canada*).

FIBRE BUSH WHEEL.—A disc of fibre stamped out to the same size as the Bush Wheel (part No. 24) and fitted with a brass boss, would no doubt be of some use in building electrical mechanisms. For example, a very neat switch could be built up by securing a number of Bolts in the radial holes of the wheel and pivoting a short crank, to form the switch arm, in the boss of the wheel, the bolts being connected to the coils of wire, lamps, etc., that are required to be switched in or out of circuit. Further instances where the suggested part could be used will no doubt be found and readers suggestions will be appreciated. (*Reply to R. Maskew, Staines*).

SPECIAL PLUG.—Your suggested screw plug would resemble the screwed portion of a miniature screw-in lamp, and would be fitted with two small projections so that flex could be connected to its screwed portion and bottom contact. The plug could then be screwed into a Lamp Holder. By employing a number of your suggested plugs and Lamp Holders mounted on a panel a very effective switch board could be devised. We doubt, however, whether the plug would be very popular if introduced, but we certainly shall consider the idea carefully. (*Reply to W. Turnbull, Kinsella, Alberta, Canada*).

IMPROVED PULLEYS.—We were interested in your suggestion that the grooves of the Pulleys should be roughened, but we would remind you that an excellent "non-slip" pulley can be devised by fastening two Bevel Wheels face to face. (*Reply to B. C. Bateman, Vaud, Switzerland*).

THREADED COUPLING.—We note your suggestion for a coupling having half of its bore threaded, while the remainder is plain, but we would point out that an identical part is already to be found in the Meccano system, the Threaded Coupling (Part No. 63c) fulfilling all the requirements of your suggested article. (*Reply to D. S. Bond, Ilford*).

FLANGED WHEEL.—Your idea that the flange of the Flanged Wheels should be serrated or "milled" interests us considerably. The advantage of manufacturing the Flanged Wheels in this way would be, of course, that a much better grip would be obtained on rails, etc. The milling would not seriously affect the other functions of the part, and we intend to carry out experiments with this idea and will report on them later. (*Reply to F. Margerison, Blackburn*).

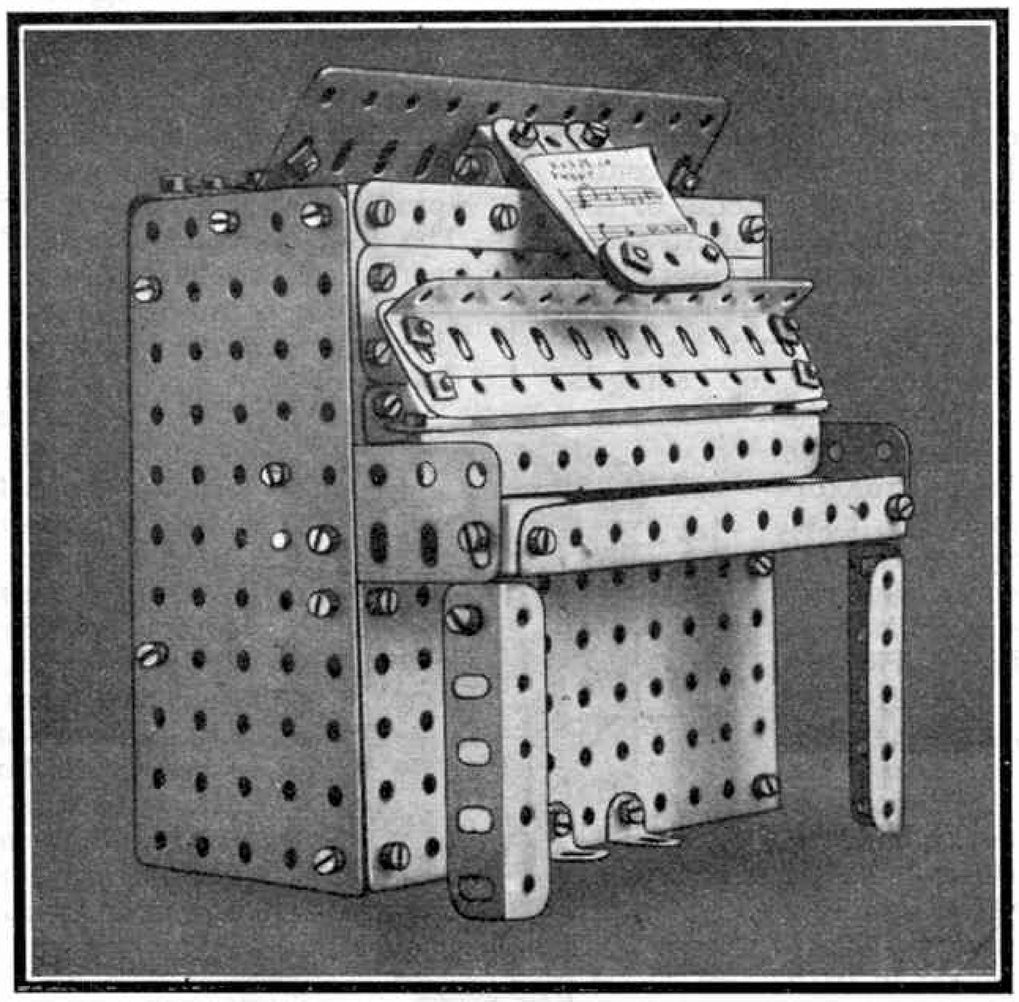
RUBBER BELTS.—We do not intend to introduce belts prepared from rubber, leather or canvas, as we consider that the existing methods of drive transmission that can be built up with standard parts fulfil all requirements. (*Reply to F. Margerison, Blackburn*).

CHAIN SLING.—A special chain sling consisting of two short chains to each of which is fastened a "can hook," and the chains secured to a ring, would certainly be an interesting part, but we suggest that you attempt to devise it from standard parts. By using Sprocket Chain and Loaded Hooks quite a realistic sling can be devised. (*Reply to C. Yates, Manchester, and F. Leek, Preston*).

IMPROVED BOLTS.—We have noted your suggestion that round or "button-head" bolts should be introduced, but we would mention that all Meccano bolts are now manufactured with a dome rivet head, which greatly enhances their appearance. This alteration in no way affects the efficiency of the bolt. (*Reply to W. J. Jaques, Charlton, S.E.7*).

Y-COUPLING.—Your proposed three-arm coupling somewhat resembling the letter "Y" is quite interesting, but we do not think there are many instances where your suggested part could be used to advantage. Perhaps readers will suggest further uses for this coupling. (*Reply to R. J. Gutteridge, Leicester, and O. R. Simpson, Salisbury*).

"Music hath Charms . . ."



New and interesting models are constantly being entered in the Model-building Contests, but it would be hard to find a more original one than the 'upright' piano shown herewith. The credit of constructing this model is due to A. Harris, of Godalming, who carried off one of the principal awards in the 1927 "Christmas" Model-building Contest. The various external details to be found in a piano of the upright type have been cleverly reproduced, not excluding even the 'loud' and 'soft' pedals. The music rack—which carries a diminutive piece of music—folds into the body of the instrument when the hinged lid is raised.

There are, of course, no strings or keys included in the model, and perhaps this is all to the good, as we dare not think what weird and wonderful noises might be emitted from the instrument!

IMPROVED CIRCULAR STRIP.—Your proposal that the 7" Circular Strip should have a number of teeth cut in its outer edge is interesting. It could then carry the swivelling superstructure of a crane, where the Ball Bearing (part No. 168) is too small, and the Roller Race (part No. 167) is too large. We are looking into the idea with a view to making this alteration. (*Reply to J. Gunner, Sydney, N.S.W.*).

CURVED FLAT GIRDER.—Although these parts would give a neat appearance to many models in which they were used, they would have a very limited application, unless a large range of curved girders of various radii were introduced. This would, of course, be a very impractical method and we consider that with a little ingenuity model-builders should be able to provide quite neat curved girders from existing parts. (*Reply to J. Summer, Stroud Green*).

SPIRAL GEARS.—The only objection to spiral gears being introduced, is their excessive cost, but if some method can be devised whereby this type of gear could be produced cheaply we will certainly take steps to include them. (*Reply to J. Kay, Hampstead, N.W.3*).

TWISTED STRIP.—Your suggested accessory resembling a standard Strip that has been twisted so that its ends lie in planes at right angles to each other, would no doubt be of use in coupling together various moving parts of a model. We doubt however, whether a part such as this could be classified as a component that might be found in engineering structures, but we will look into the idea more deeply in the future. (*Reply to T. Dowty, Whaddon*).

RUBBER PINIONS.—Much of the noise caused when the existing metal Gear Wheels and Pinions are meshed together, could be eliminated by using pinions manufactured from hand vulcanised rubber. The main objection to these pinions is, however, that they would not be durable, and could not stand up to great strain when meshed with a wheel at high speed for any length of time. This would mean that they would have to be replaced constantly and would be generally unsatisfactory. For those of our readers who would like to try out the idea we would mention that a "½" rubber pinion" can be improvised by slipping a short length of ⅜" Rubber Gas Tubing over a standard Coupling. (*Reply to S. T. Victor, Oxford, and L. R. Hanton, Manchester*).

BELT PULLEY.—There is no necessity for us to introduce a belt pulley resembling the existing Flanged Wheel, but with a second "lip" enclosing the flange, as there are numerous ways in which your suggested pulley can be devised with existing parts. For instance a Flanged Wheel with a Bush Wheel bolted against its flange, forms an excellent belt pulley or if an extra wide pulley is required, two Flanged Wheels bolted flange to flange may be employed. (*Reply to J. Stennett, Windsor*).

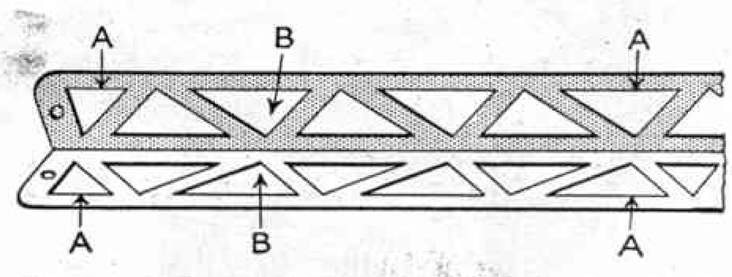
ARMATURE.—There would be little advantage to be gained by supplying the armature of the 4-volt Electric Motor as a separate Meccano accessory. The armature is specially designed so that it produces maximum results when enclosed in the specially shaped field core of the Motor and if it were employed in the construction of a built-up motor composed of Meccano parts results would not be satisfactory. Moreover, the constructor who employed a manufactured armature in his motor would be denied one of the greatest joys in Meccano model-building, i.e. of constructing each individual part from standard accessories. (*Reply to K. Lawson, Hull*).

INTERNAL TOOTH GEAR.—A circular rack strip having internal and external teeth would be of considerable use in the construction of an epicyclic gear box. We are making a special note of your idea and will go into the question of size, etc., as soon as possible. (*Reply to V. Smith, Dublin, C.18*).

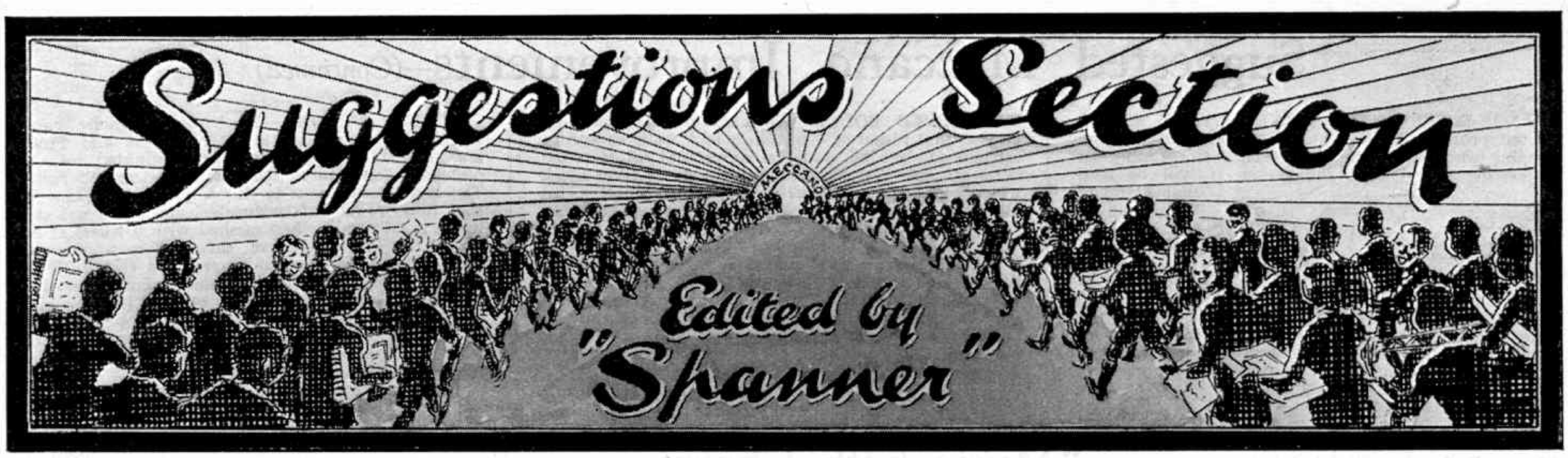
BRAKE SHOE.—We do not think that it would be advisable to introduce a special brake shoe for use in models of internal expanding brakes. The brakes fitted to the rear wheels of the motor chassis (Model 7.1) employ Collars as brake shoes, and while of course, these brakes do not conform exactly to actual internal expanding brakes, they operate remarkably well. (*Reply to V. Smith, Dublin, C.18*).

SPECIAL CLIPS.—To supply as separate components the clips at present fitted to the Dredger Buckets, would, we consider, be a good idea, as there are several instances where these clips can be used in conjunction with standard Meccano parts. For example, it is possible to build up quite a realistic caterpillar track by attaching a number of Flat Brackets to a double length of Sprocket Chain by means of these clips. We will certainly give your proposal attention. (*Reply to E. Whalley, Blackburn*).

LATTICE GIRDER.—We are afraid that you are under an entirely wrong impression in thinking that the addition of a lattice girder similar to the sketch would constitute an improvement. If manufactured to a similar size to the existing Angle Girders it would be technically incorrect as the size of the bracings and joining strips of which the girder would be composed would be out of scale with other Meccano parts. The girder would also be comparatively weak, as the



thinness of the portions marked A in the sketch will be noted. Considerable difficulty would also be experienced in attaching other Strips, etc., to the girder on account of the triangular openings B. You will find it much better to build up your own lattice girders from existing parts (see the article "How to use Meccano Parts," January, 1929, "*M.M.*," page 38). *Reply to J. McLaurin, Leith*).



(159)—Automatic Traffic Control Signal

(J. R. Sprent, Portsmouth)

AS many of our readers are doubtless aware, automatic traffic signalling has recently found favour with the authorities of some of our larger towns, and we feel sure that Meccano boys will welcome the opportunity of constructing a model of the actual device shown in Fig. 159. The model demonstrates the working of one of these "robots of the police force" remarkably well!

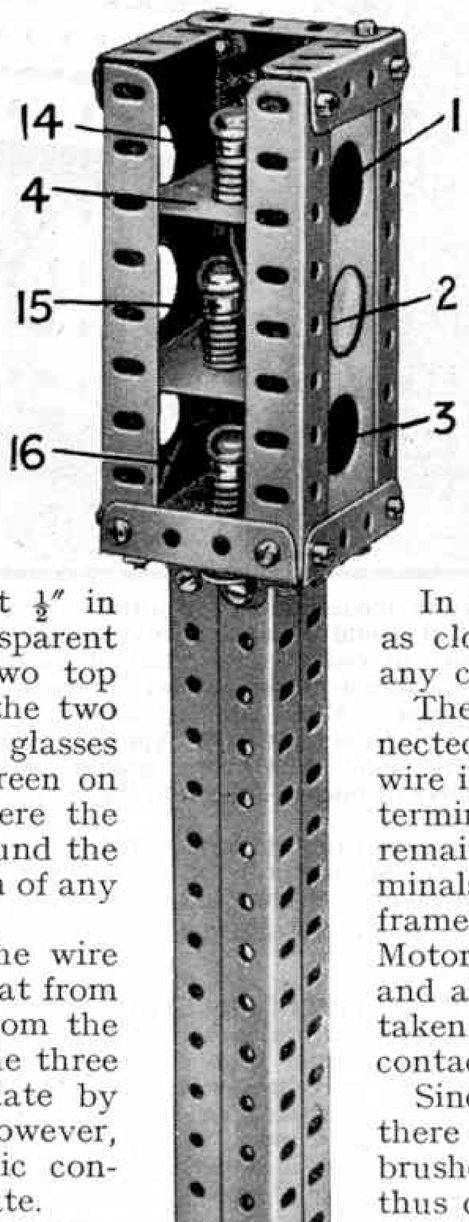
The construction of the lamp standard should first be commenced. As will be seen from the illustration, the lamp casing is composed of 4½" and 2" Angle Girders bolted to the top of a column consisting of 9½" Angle Girders. The latter are attached by means of 1" × 1" Angle Brackets to the 5½" × 2½" Flanged Plate forming the base.

Three 1" × ½" Angle Brackets, secured to the 4½" Angle Girders, have Flat Brackets bolted in their end holes and at right angles to them. The Flat Brackets serve as a means of attaching the Lamp Holders carrying the Lamps 14, 15, 16 and the Lamp Holders are secured to them in the following manner. A 6 B.A. Bolt is passed through both the hole in the base of the Lamp Holder and that in the Flat Bracket. An Insulating Bush is then placed on the Bolt so that the shank is insulated from the Flat Bracket. Lastly a 6 B.A. Nut serves to retain the whole in place, a length of insulated wire being clamped beneath the nut.

The four sides of the lamp casing are filled in with cardboard, and in each piece three holes are cut out ½" in diameter and pieces of red, orange, and green transparent paper stuck over the holes. When in place the two top "glasses" on opposite sides should show red, whilst the two remaining sides show green. Each of the middle glasses should be orange, whilst the bottom ones should be green on the sides where the top glasses are red, and red where the upper ones are green. Cardboard masks 4 are fitted round the base of the Lamp Holders in order that the illumination of any one Lamp may be confined to its own set of glasses.

Four terminals are provided on the base plate. The wire from the Lamp 14 is connected to the terminal 5 and that from the Lamp 15 connected to the terminal 6, the wire from the Lamp 16 being taken to the remaining terminal 7. The three terminals mentioned are insulated from the base plate by Insulating Bushes and Washers; the terminal E, however, is in direct metallic contact with the Plate.

Attention should now be paid to the rotary switch gear. The Rod carrying the rotary switches 9, 10, 11, 12 is driven by a 6-volt Meccano Electric Motor through a reduction gear of a ratio of 1083 : 1. This ratio is obtained by a Worm on the armature spindle that meshes with a 57-teeth Gear secured on a short Rod. The Rod, journalled in Girder Brackets on the Motor side plates, carries a Worm in mesh with a ½" Pinion on the rotary switch shaft. The Motor is mounted on a base built-up from Angle Girders that also carry Architraves to accommodate the rear ends of the switch shaft and the Rod carrying the brushes.



Each of the rotary switches consists of a Face Plate secured firmly to the shaft and carrying six ½" × ½" Angle Brackets, which are attached to the Face Plate by means of 6 B.A. Bolts and Nuts and insulated therefrom by Insulating Bushes and Washers.

The brushes that press on the peripheries of the rotary switches consist of 3½" Strips. A Double Bracket is attached to one end of each Strip and is insulated from it in the usual manner. The brushes are mounted on a Rod and kept the correct distance apart by Collars, so that their ends fall on the peripheries of the switches. Each one is kept in proper contact by means of a short length of Spring Cord, one end of which is secured to the brush and the other end to an insulated 6 B.A. Bolt attached to the frame.

Connecting up the Model

In Fig. 159 the switch gear and lamp standard are shown as close together as possible. They can, however, be of any convenient distance apart.

The brushes pressing on the switches 9 and 11 are connected together by a short length of insulated wire 13 and a wire is taken from the latter brush to the terminal 6. The terminal 5 is connected to the brush of the switch 10 and the remaining brush to the terminal 7. One of the Motor terminals is earthed by a short piece of wire connected to the frame and the terminal, whilst the other terminal of the Motor is connected to the terminal E on the lamp standard, and also to the Accumulator, the return lead from which is taken to the terminal 8. The latter is in direct metallic contact with the Motor side plate.

Since there are six Angle Brackets on each Face Plate, there is therefore a gap in their continuity, by which the brushes are permitted to touch the rim of the rotary switch, thus completing the circuit. The mechanism should be so arranged that when the upper Lamp is extinguished, by the brush controlling that light passing on to the first of the series of insulated Angle Brackets of the switch, the middle or orange lamp is lit immediately by the brush passing on to the uninsulated portion of the switch 9. As soon as the orange light is extinguished the lower lamp, controlled by the switch 12 should be illuminated. When it goes out the orange light appears again. It is now, however, under the control of the switch 11. Hence the reason for joining the switches 9 and 11. The orange light has to appear twice in a cycle and the only way in which this could be accomplished other than the present scheme would be to arrange one switch to rotate at twice the speed of the others. Although this arrangement would eliminate one switch it would make matters much more complicated.

In actual practice, a driver, on approaching the crossing, notices which lamp disc is illuminated, the green indicating "all clear," the orange proclaiming that caution is necessary, and that he must go slowly, while the red commands him to stop.

Fig. 159
General view of device with one side of lamp casing removed

(160)—Grisen Gear Box

(A. Golding, London, E.11)

There is no doubt that gear box mechanisms in their many forms are extremely popular with a large majority of our readers, for we receive regularly a large number of suggestions concerning these devices.

In actual engineering practice the designing of an efficient gear box is an exceedingly difficult problem, and new inventions and improvements are constantly being produced.

The model gear box illustrated in Fig. 160 possesses several salient features of interest, chief amongst which may be mentioned the very novel method of changing from one gear ratio to another.

A 4½″ Rod journalled in the 3½″ × 2½″ Flanged Plates forming the sides of the gear box, is free to slide longitudinally. It has a ¾″ Pinion 1 secured to it and it also carries a Coupling in which is held a Rod representing the gear lever. The latter has two Couplings secured to it, one carrying a 1″ Gear Wheel 2 by means of a Pivot Bolt that is inserted in one of its tapped holes, and the other, which forms the top of the gear change lever, has a 1″ Rod 3 sliding freely in the end transverse bore.

A ¾″ Pinion 5, a 1″ Gear Wheel (not shown in the photograph) and a 50-teeth Gear Wheel 6 are mounted at short distances apart on the Rod 4.

The Pinion 1 and the Gear 2 are in constant mesh and the latter may be brought into engagement with the 50-teeth Gear 6 by moving the gear lever with a combined vertical and lateral movement until the plunger Rod 3 of the gear change lever is enabled to fall into the end hole of the 1½″ Strip 7. This gives a reduction ratio between the driving and driven shafts. By placing the plunger rod in the end holes of the 2″ Strip, as shown in the illustration, the 1″ Gear 6 may be made to mesh with the other similar Gear on the driven shaft; this gives a ratio of unity.

Lastly, when the plunger rod is made to drop into the hole of the Flat Bracket 8, the 1″ Gear 6 and the ¾″ Pinion 5 are engaged. A step-up ratio is now obtained.

It will be apparent, of course, that the distance between the 2″ and 1½″ Strips and the Flat Bracket should be carefully adjusted so that the Gear 2 meshes correctly with those on the shaft 4. The distance between the respective Gears on the same shaft is also important; it should be carefully adjusted so that only one Gear and not two at a time, are engaged.

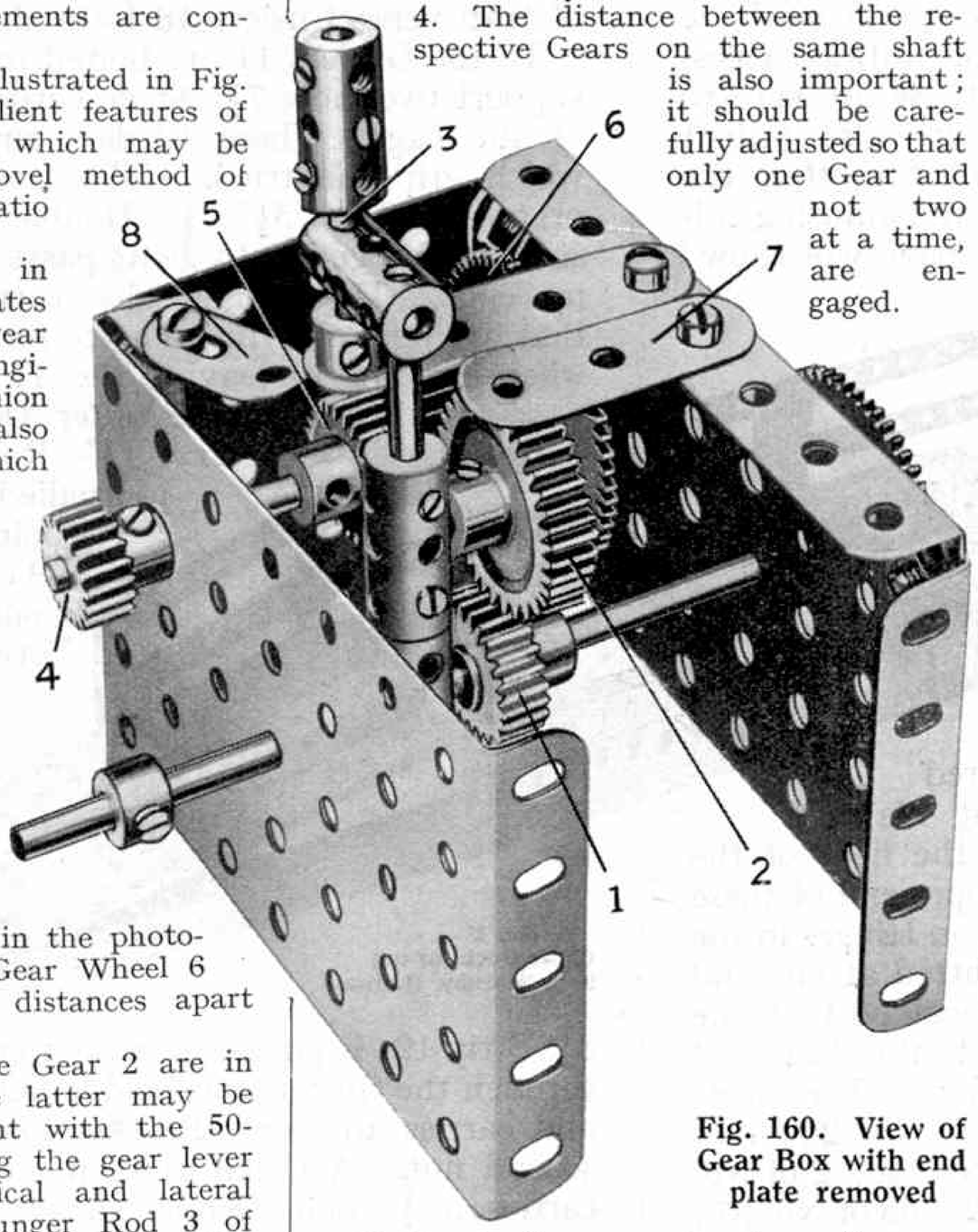


Fig. 160. View of Gear Box with end plate removed

Owing to its compact nature, the gear box is particularly suitable for inclusion in a model motor chassis, and constructors should have little difficulty in fitting their models with the device.

We feel sure readers will agree that the above gear box demonstrates a principle entirely new to Meccano, and as such is worthy to be included in the pages of the "Suggestions Section."

(161)—Free Wheel Clutch

(P. T. Atkinson, Norton-on-Tees)

A free wheel movement has been the subject of previous suggestions that have appeared from time to time in the "*M.M.*" An example that occurs to the mind is the free wheel device described under Suggestion No. 54 in the August, 1926, "*M.M.*" The free wheel clutch that we are concerned with this month is, however, conceived on rather different lines.

It comprises two 3″ Pulleys (see Fig. 161) joined together by means of two 2″ Screwed Rods. Four nuts on each of the Rods serve to hold the Pulleys in place on the Rods the correct distance apart, which should be such that the two 1⅛″ Flanged Wheels 1 may be accommodated in the space between. The Flanged Wheels are bolted together face to face and secured on a 3½″ Rod which is free to turn in the bosses of the 3″ Pulleys.

A short length of Meccano Cord 2 is doubled and wrapped round the Wheels. The free ends are then passed through the loop and secured to one of the Screwed Rods as shown in the illustration. It will be found that when the 3½″ Rod is prevented from rotating it is possible to turn the 3″ Pulleys easily in one direction, but in the reverse direction considerably greater effort is needed.

Many instances of the use of this model will occur to Meccano boys. For example it could be included in the drive of a model Big Wheel or roundabout so that when the Motor was stopped, instead of the model coming to an abrupt standstill and straining the gearing, it would come to rest gradually.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.50). Novel Wind Motor.—A very ingenious idea for a wind motor has been devised by D. Williams (Hampstead). It consists essentially of a Fan (part No. 157) that is secured on a Rod journalled in suitable bearings. The nozzle of a vacuum cleaner is arranged just in front of the Fan so that when the motor of the cleaner is started up the suction sets the Fan rotating rapidly. The motor is doubtless very interesting from an experimental point of view, but it is not powerful enough for practical purposes. The possibilities of utilising wind as motive power in Meccano models were dealt with in the January, 1926, "Suggestions Section." In this case a truck was propelled by a fan, which was mounted on the truck and connected by a belt to the driving axle. The fan was rotated by wind power or by an artificially-created draught.

(M.51). Model Windscreens.—It is pointed out by B. Stuart (Armagh) that microscope slides form excellent wind screens for model motor cars. The idea had certainly not occurred to us before, and we should imagine that the slides would answer the purpose very well. It should be a simple matter to mount them by clamping them between Strips, etc.

(M.52). Improved Front Axle.—A front axle composed of a Rod and secured to the front springs by Handrail Supports is suggested by J. McDonald (Roseville) in place of the more usual Strips and Cranks. A front axle made in this way is certainly quite satisfactory and should look extremely neat.

(M.53). Extension Terminals for Electric Motor.—Many users of the Meccano Electric Motor will have doubtless found that it is difficult to secure the connecting wires to the terminals. L. Simonds (Bromley) suggests that Threaded Rods of the desired length be attached to the shanks of the terminals by Threaded Bosses. The idea is quite sound but care would have to be taken to see that the Threaded Rods do not touch any portions of the model in which the Motor is incorporated, or a "short circuit" will occur, with detrimental effect to the Accumulator.

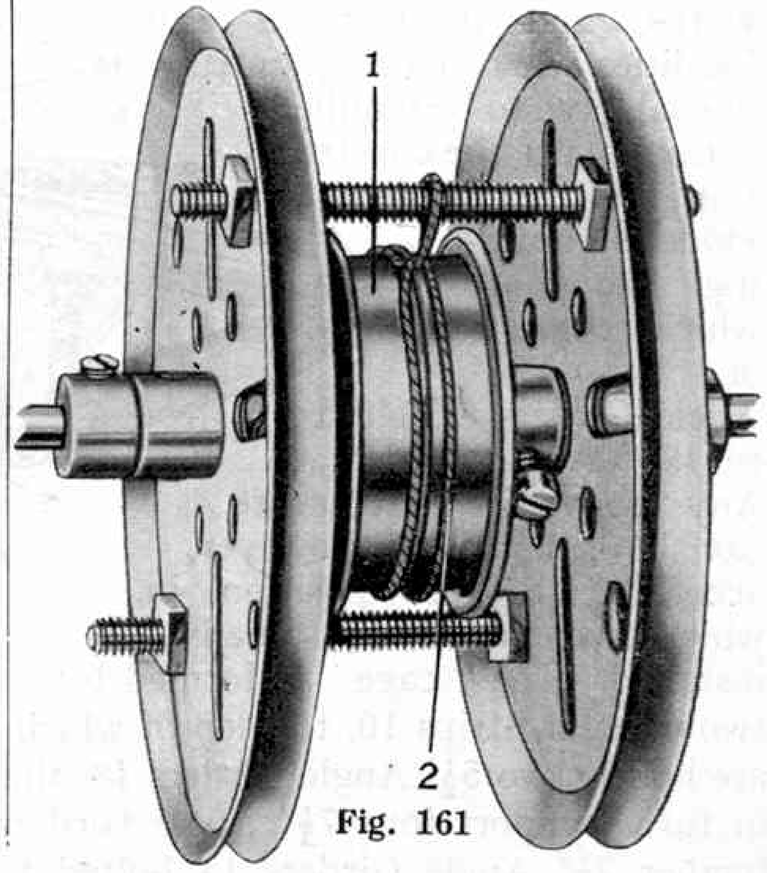


Fig. 161

New Meccano Models

Cattle Dock—Rotary Tipper—Meccano Hen—Centrifugal Governor, etc.

AMONG the models illustrated this month we have included two further examples of railway accessories built from Meccano, and these are sure to be appreciated by constructors who are also ardent Hornby "Railwayites." We have not forgotten the younger builder, however, as the varied and amusing collection of small models on the opposite page will show!

Cattle Dock

Fig. 1 shows a Cattle Dock, an article that will be found in the goods yard of practically every country station.

The base frame of the model consists of two 18½" and two 3½" Angle Girders. To each of the side Girders four 3½" Strips are bolted in a vertical position, and to these are secured two 12½" Angle Girders, 5½"×3½" Flat Plates being bolted to these Girders to form the floor of the Dock. The railings are bolted to the upper end of these Strips, and two small gates are mounted on Hinges in the positions shown. A 3½" Strip is lock-nutted at one end to an Angle Bracket secured to a vertical post at the sloping end of the platform, and prevents the "cattle" leaving the enclosure without permission! The parts required to build this model are:—4 of No. 2; 4 of No. 2a; 13 of No. 3; 4 of No. 5; 6 of No. 6a; 2 of No. 7a; 2 of No. 8; 2 of No. 9b; 3 of No. 12; 65 of No. 37; 1 of No. 37a; 2 of No. 48b; 4 of No. 52a; 2 of No. 103b; 4 of No. 114.

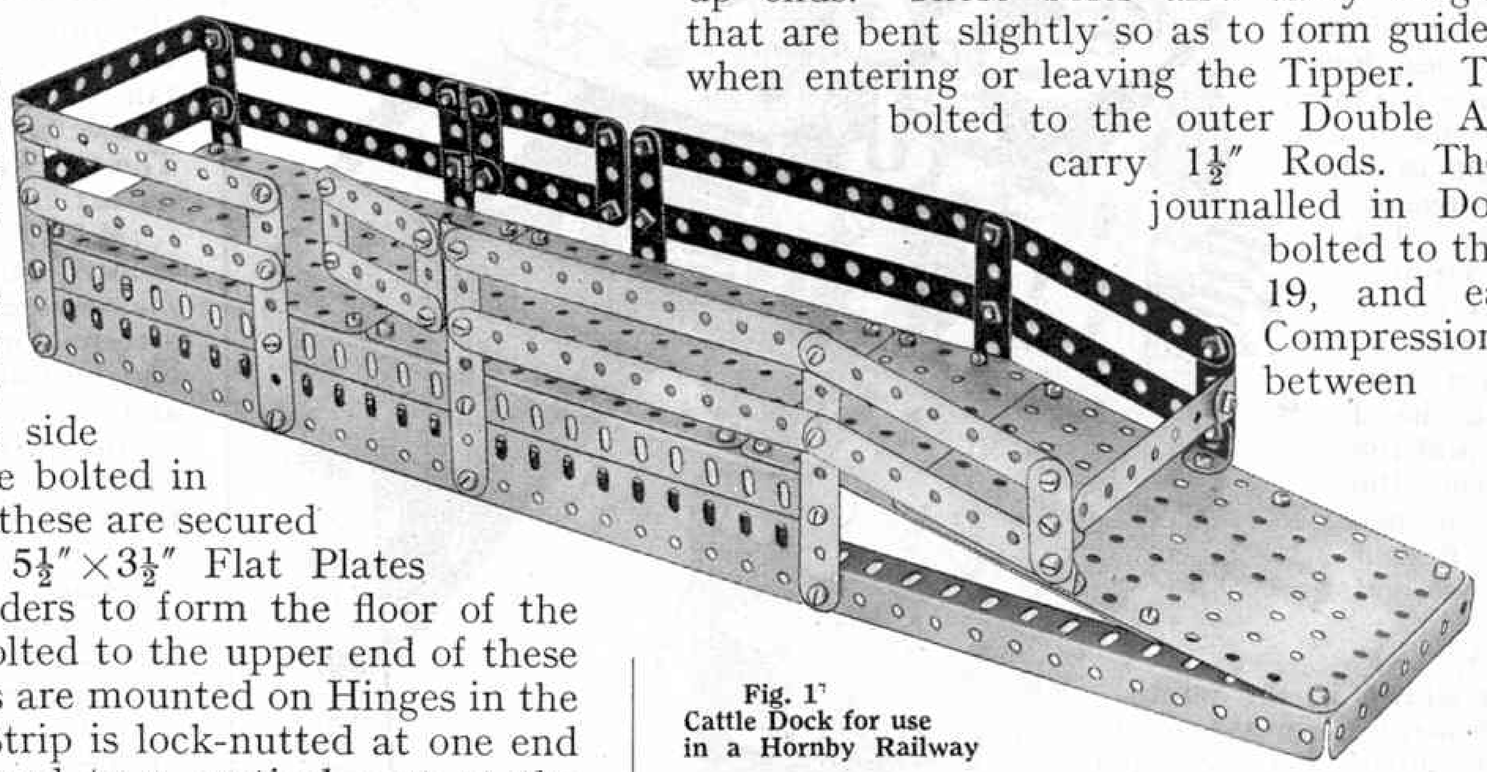


Fig. 1. Cattle Dock for use in a Hornby Railway

Rotary Wagon Tipper

Prototypes of the Rotary Wagon Tipper shown in Fig. 2 are frequently to be found in the sidings adjoining gas or iron works, and in fact in any localities where large quantities of coal have to be handled.

Commence the construction of the model by building the base which consists of five 9½" Angle Girders 8 bolted to 18½" Angle Girders 9. Any convenient structure can be substituted however, according to the position in which the model will finally be installed. The "cage" is formed by two circular Strips 10, to each of which are bolted two 5½" Angle Girders 18, that, in turn, support four 7½" Angle Girders 11. Two further 7½" Angle Girders 14 bolted to the lower pair of transverse Girders 18 form the rail track.

To the Girders 11 are bolted four 3½" Strips 16 which support two more 7½" Angle Girders 19, one on each side of the cage. These Girders support spring "pads" which grip the truck whilst tipping operations are in progress. Two 5½"×½" Double Angle Strips 12 are connected together by bolts passed through their turned-up ends. These bolts also carry Angle Brackets 20 that are bent slightly so as to form guides for the truck when entering or leaving the Tipper. Two Cranks 13, bolted to the outer Double Angle Strips 12 carry 1½" Rods. These Rods are journalled in Double Brackets bolted to the Angle Girder 19, and each carries a Compression Spring placed between the Double Brackets and the inner Double Angle Strip 12.

After passing the Rods through the Double Brackets, a 3½" Strip 12a is placed over their ends. A bolt 15 passed through the Girder 19 is held loosely in position by a nut, and carries an Angle Bracket locked on the bolt by a second nut. A Collar is then secured to the Bolt and carries a ½" bolt 15a as shown. This completes the "gripping" device, and it will now be found that the Double Angle Strips 12 are forced by the Springs against the sides of the trucks. Using the bolt 15a as a lever to turn the bolt 15, the corner of the Angle Bracket may be brought into contact with the Strip 12a, thus drawing the pad 12 inwards and releasing the truck. The gripping device is duplicated on the other side of the cage.

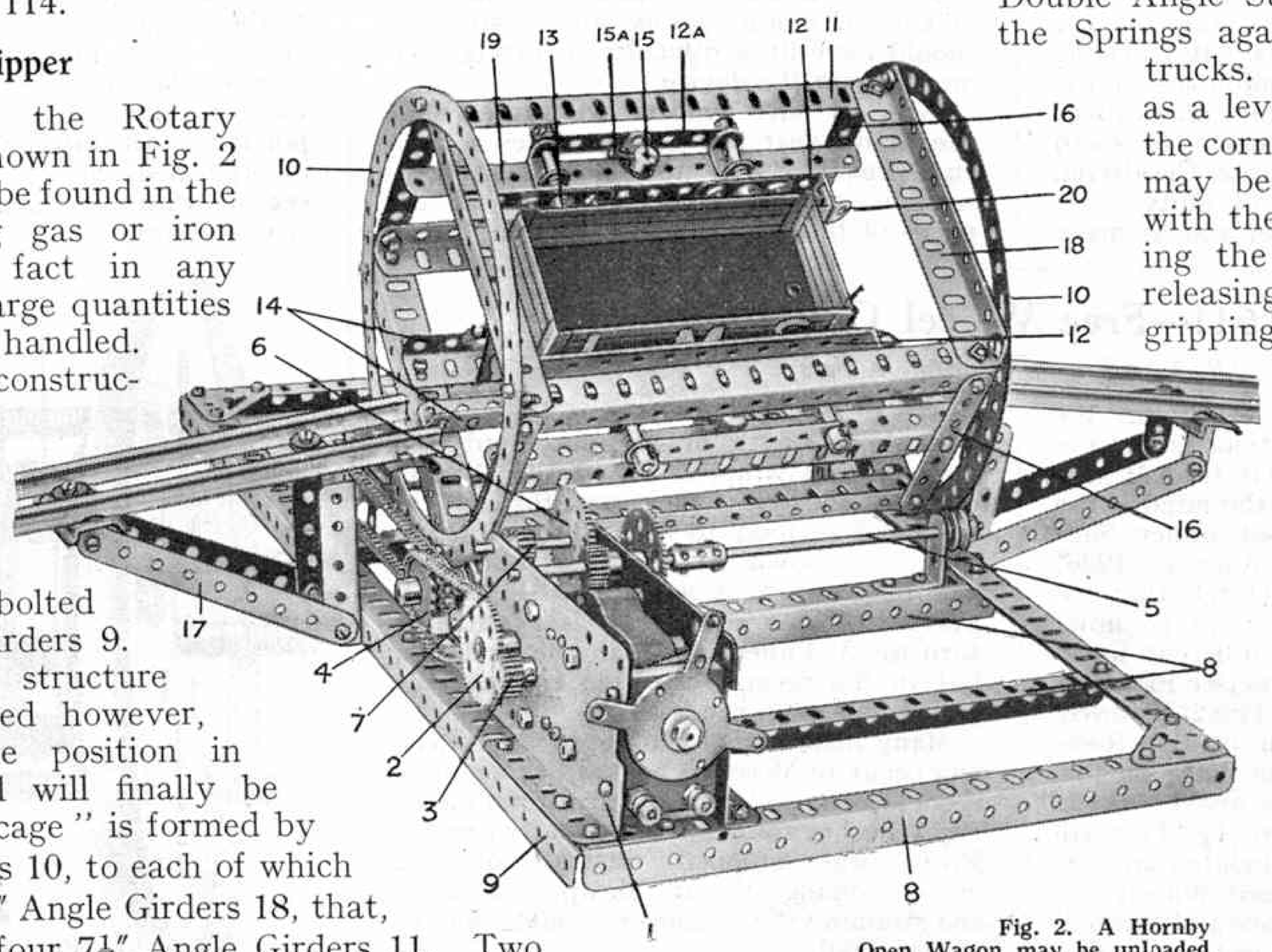


Fig. 2. A Hornby Open Wagon may be unloaded by means of this Rotary Tipper

The cage rests on four Pulleys mounted on Rods 5 (two 4½" Rods coupled together) and journalled in 1"×1" Angle Brackets bolted to the Angle Girder 8.

A 6-volt Electric Motor is mounted on the base of the model, and a ½" Pinion 3 on the armature spindle engages a 57-teeth Gear, the spindle of

which carries on the other side of the motor a $\frac{1}{2}$" Pinion engaging a further 57-teeth Gear. The Rod of this last gear carries a $\frac{1}{2}$" Pinion meshing with another 57-teeth Gear 6, on the Rod of which is a further $\frac{1}{2}$" Pinion 7 engaging a further 57-teeth Gear carried on a Rod journalled in the Motor framework. On this Rod is a $\frac{3}{4}$" Sprocket connected by Sprocket Chain to a 1" Sprocket Wheel 4 on one of the Rods 5. The latter carries also a $\frac{3}{4}$" Sprocket Wheel connected by Sprocket Chain to a $\frac{3}{4}$" Sprocket Wheel on the other Rod 5. Rotation of the Motor causes the Rods 5 with their Pulleys to revolve, and the Pulleys to impart rotary movement to the cage.

The model can be built from the following parts : 9 of No. 2a ; 6 of No. 3 ; 2 of No. 7a ; 5 of No. 8a ; 8 of No. 8b ; 4 of No. 9 ; 4 of No. 9d ; 2 of No. 9f ; 4 of No. 11 ; 8 of No. 12 ; 4 of No. 12a ; 2 of No. 12b ; 4 of No. 15a ; 5 of No. 16a ; 4 of No. 18a ; 4 of No. 23a ; 4 of No. 26 ; 4 of No. 27a ; 98 of No. 37 ; 4 of No. 37a ; 8 of No. 38 ; 4 of No. 48d; 7 of No. 59 ; 4 of No. 62 ; 2 of No. 63 ; 18" of No. 94 ; 1 of No. 96 ; 3 of No. 96a ; 4 of No. 111a ; 4 of No. 120b ; 4 of No. 133 ; 2 of No. 145 ; 6-volt Electric Motor.

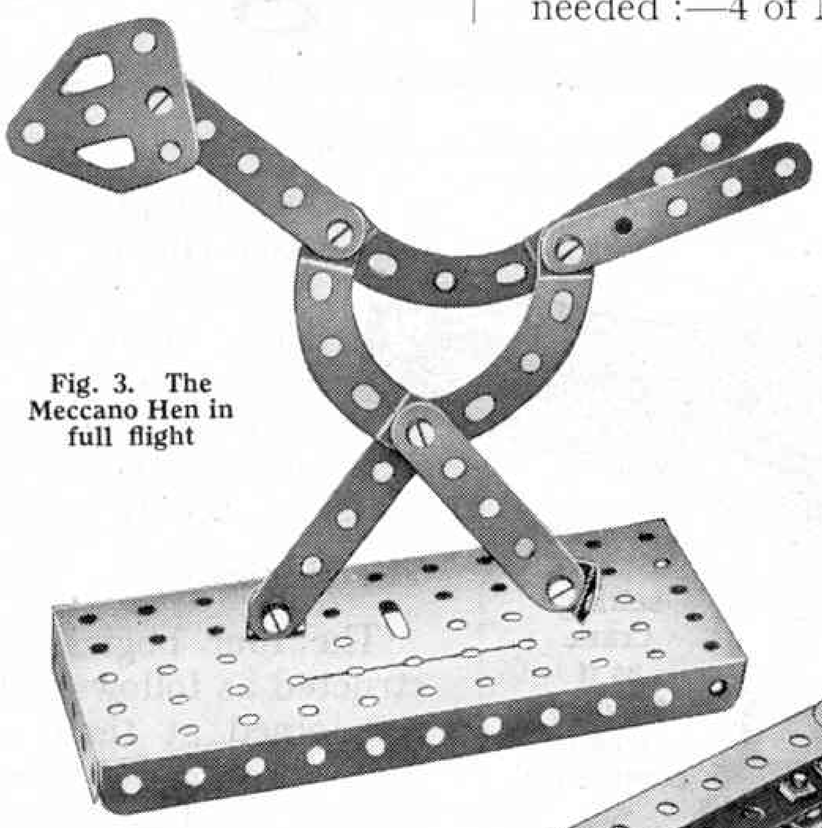


Fig. 3. The Meccano Hen in full flight

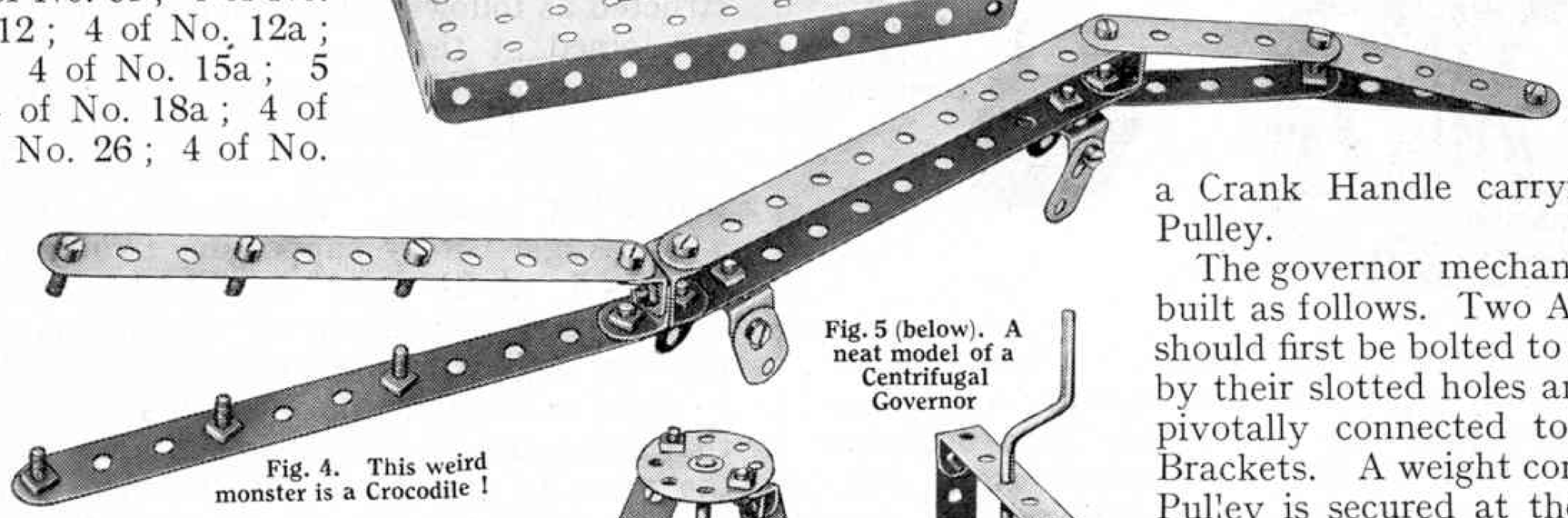


Fig. 4. This weird monster is a Crocodile !

The Meccano Hen

The remarkable model shown in Fig. 3 has been christened a hen, but we leave it to our readers to decide whether it is worthy of such a title or not !

The hen's "body" consists of $2\frac{1}{2}$" Curved Strips with $2\frac{1}{2}$" Strips for legs, neck and tail. A Flat Trunnion forms the head and the model is completed by mounting it upon a $5\frac{1}{2}$" $\times 2\frac{1}{2}$" Flanged Plate, by means of Angle Brackets. To build this model the following parts are required :—5 of No. 5 ; 2 of No. 12 ; 7 of No. 37 ; 1 of No. 52 ; 3 of No. 90a ; 1 of No. 126a.



Fig. 6. The latest addition to the range of Meccano celebrities—The Missing Link !

A Remarkable Crocodile!

A fearsome monster is the crocodile shown in Fig. 4, with its gaping jaws studded with a number of large and terrifying "fangs !"

Two $5\frac{1}{2}$" Strips should be bolted at each end to a Double Bracket to form the crocodile's body, while two Strips secured by means of Angle Brackets represent its jaws. The tail is built-up from $2\frac{1}{2}$" Strips and Flat Brackets are bolted to Double Brackets to form legs. Do not forget to fasten three $\frac{3}{8}$" Bolts to each of the jaws to represent the teeth of this remarkable reptile.

In building the crocodile the following parts will be needed :—4 of No. 2 ; 4 of No. 5 ; 4 of No. 10 ; 4 of No. 11 ; 2 of No. 12 ; 16 of No. 37 ; 6 of No. 37a ; 6 of No. 111c.

Centrifugal Governor

By building the compact little model shown in Fig. 5 a good idea of the working of a centrifugal governor, commonly fitted to stationary steam engines, can be obtained.

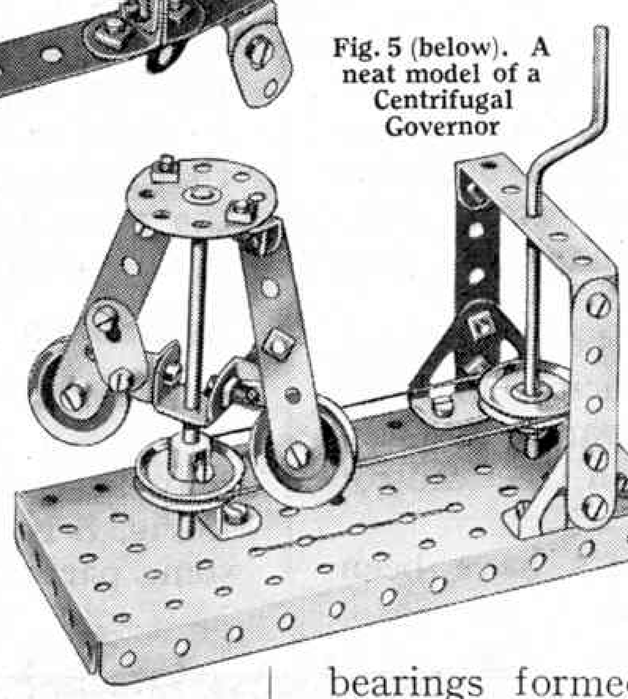


Fig. 5 (below). A neat model of a Centrifugal Governor

The base of the model consists of a $5\frac{1}{2}$" $\times 2\frac{1}{2}$" Flanged Plate. At one end two Trunnions should be bolted and to each of these a $2\frac{1}{2}$" Strip secured. A $2\frac{1}{2}$" $\times \frac{1}{2}$" Double Angle Strip connects the Strips at their upper ends thus forming a bearing for a Crank Handle carrying a 1" fast Pulley.

The governor mechanism should be built as follows. Two Angle Brackets should first be bolted to a Bush Wheel by their slotted holes and a $2\frac{1}{2}$" Strip pivotally connected to each of the Brackets. A weight consisting of a 1" Pulley is secured at the end of each Strip by means of a $\frac{3}{8}$" Bolt. Flat Brackets, lock-nutted to the centre holes of the Strips, are also lock-nutted to the Angle Brackets bolted on either side of a Double Bracket. A $3\frac{1}{2}$" Axle Rod is secured in the boss of a Bush Wheel and passes through the centre hole of the Double Bracket. The complete unit is mounted in bearings formed by a $\frac{1}{2}$" Reversed Angle Bracket and the Flanged Plate, the drive being transmitted from the Crank Handle to a 1" Pulley on the governor shaft by means of cord.

The parts required for the model are :—4 of No. 5 ; 2 of No. 10 ; 1 of No. 11 ; 4 of No. 12 ; 1 of No. 16 ; 1 of No. 19s ; 4 of No. 22 ; 1 of No. 24 ; 3 of No. 35 ; 21 of No. 37 ; 6 of No. 37a ; 1 of No. 48a ; 1 of No. 52 ; 2 of No. 111c ; 1 of No. 125 ; 2 of No. 126.

The Missing Link

Of all the models that we have illustrated in these articles in the past, that shown in Fig. 6 is surely the strangest ! This weird individual has been aptly called The Missing Link !

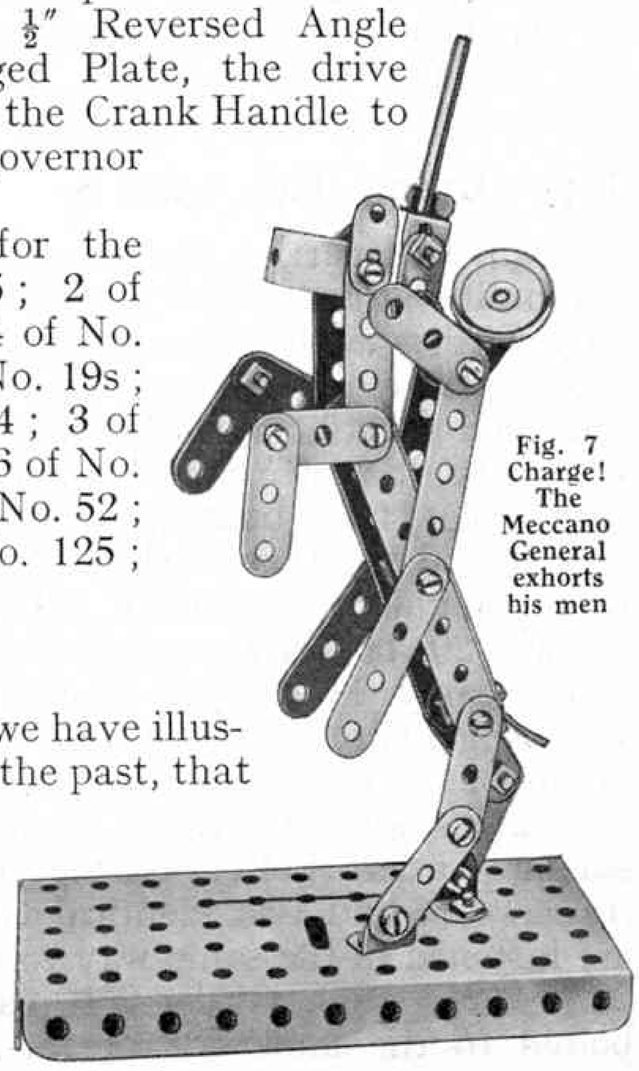


Fig. 7 Charge! The Meccano General exhorts his men

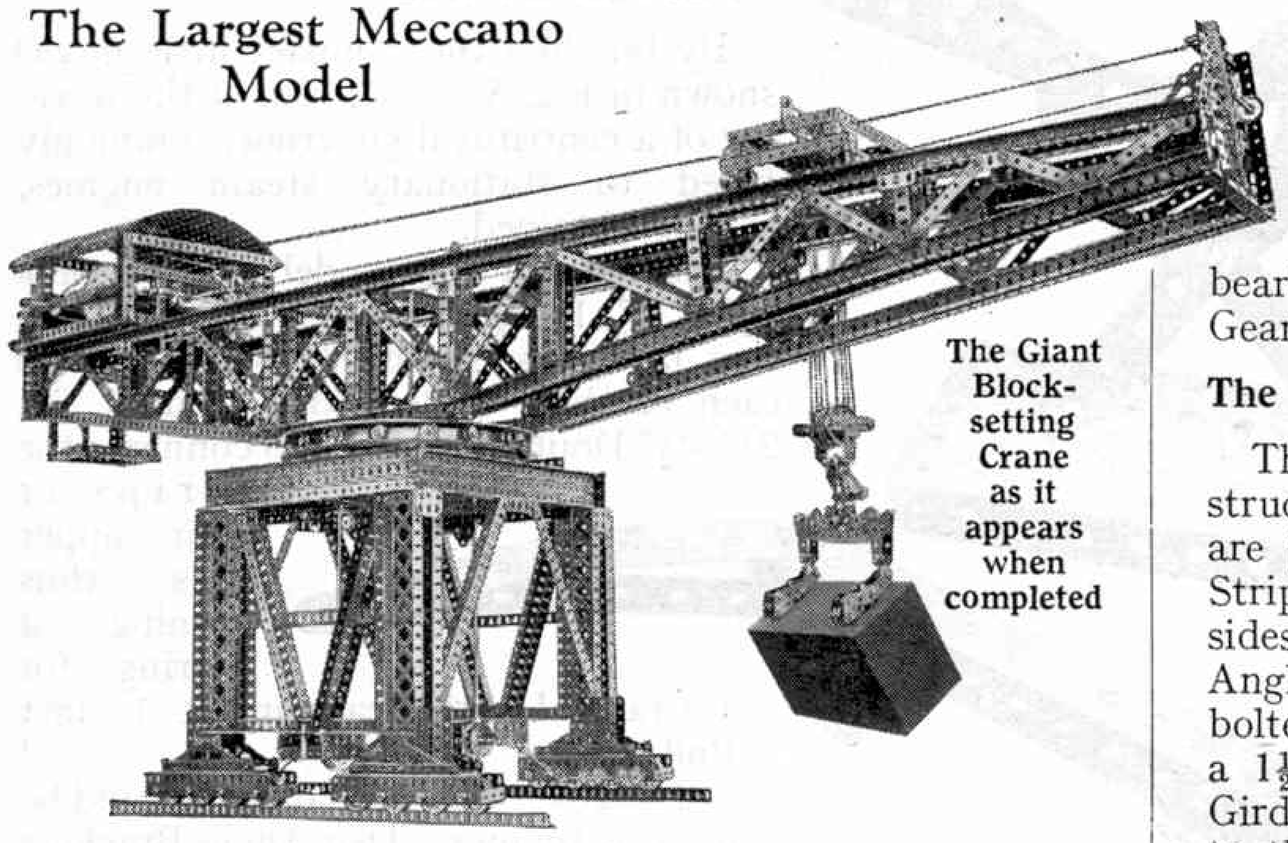
(Continued on page 495)

Super Model No. 4:

Block-setting Crane

(Continued from last month)

The Largest Meccano Model



The Giant Block-setting Crane as it appears when completed

THE first article on the Meccano Giant Block-setting Crane appeared last month, and contained details of the use of this type of crane in the construction of harbours, breakwaters, etc., and also instructions for building the Boom and part of the Gantry of the Meccano model itself.

As stated last month this model has been designed on the unit system, i.e., each of the principal portions of the crane are first constructed as separate models, and the portions finally assembled with the aid of a few nuts and bolts.

Provided the Boom and Gantry pillars have been built up, the builder may next turn his attention to the construction of the top of the Gantry. Instructions for building this, together with details of the travelling gear and Roller Race are published herewith.

Top of Gantry (Figs. 6 and 8)

Begin this part of the crane by building four composite girders, each consisting of two $12\frac{1}{2}$" Flat Girders with the round holes of one overlapping the elongated holes of the other throughout their length, four $12\frac{1}{2}$" Angle Girders being bolted to the two edges to form an H-section joist. The four built-up joists or girders are now bolted together as shown in Fig. 6, making a rectangular framework. Two $12\frac{1}{2}$" Angle Girders 20, bolted across the top of this framework, carry $1\frac{1}{2}$" Angle Girders 21, while the $12\frac{1}{2}$" Angle Girders 22, 23, join the inside middle points of the pairs of Girders 24, 25 respectively. Two $2\frac{1}{2}$" Angle Girders 26 are attached to similar Girders bolted to the rectangular framework, and two identical Girders 26a are fastened in the same way to the Girder 22. A $2\frac{1}{2}$" Angle Girder 26b may be seen bolted to the underside of the Girder in the foreground of Fig. 6, and a corresponding part should be fitted to the back of the frame.

Across the bottom of the framework are two $12\frac{1}{2}$" Angle Girders 27, and two Flat Trunnions bolted to the middle points of these Girders, together with the $1" \times 1"$ Angle Bracket 28, form bearings for the 8" Rod 29, to which three $\frac{7}{8}$" Bevel Gears 97, 98 are secured in the positions shown.

The Bogies

The four bogies on which the crane runs are constructed as follows: Two Flat Girders 1 and 1a (Fig. 9) are joined at their ends by $1\frac{1}{2}$" by $\frac{1}{2}$" Double Angle Strips. Two $5\frac{1}{2}$" Angle Girders 2, bolted to the inner sides of the Flat Girders, are joined by $1\frac{1}{2}$" by $\frac{1}{2}$" Double Angle Strips that carry two pairs of Girder Frames bolted flat together. The Girders 2 are also joined by a $1\frac{1}{2}$" Angle Girder supporting two upright $2\frac{1}{2}$" Angle Girders 5. A $2\frac{1}{2}$" by 1" Double Angle Strip 6 is bolted to the outer side of one of the Girders 1, 1a. Two of the four bogies are built with this Strip 6 on the Girder 1, while in the remaining two it is on the Girder 1a, so that, when finished, one pair of bogies should be exactly the same in appearance as the other pair would look if viewed with the aid of a mirror in the reverse position.

Assembling the Gantry

The top, sides, and bogies of the gantry having now been built as separate units, the gantry itself may be completely assembled.

Fig. 8 is a sectional view of a portion of the gantry, some parts of which have been removed for the sake of

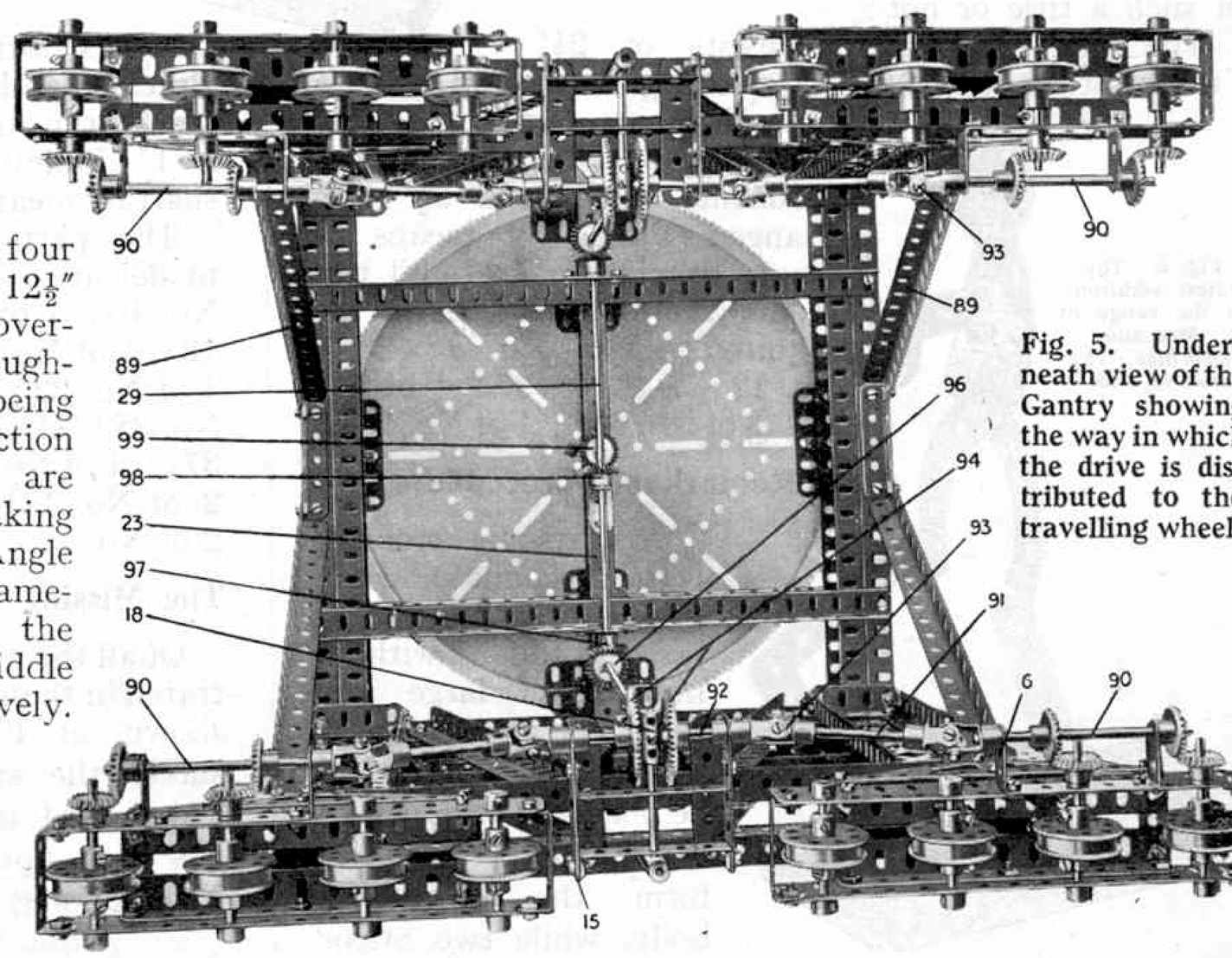


Fig. 5. Underneath view of the Gantry showing the way in which the drive is distributed to the travelling wheels

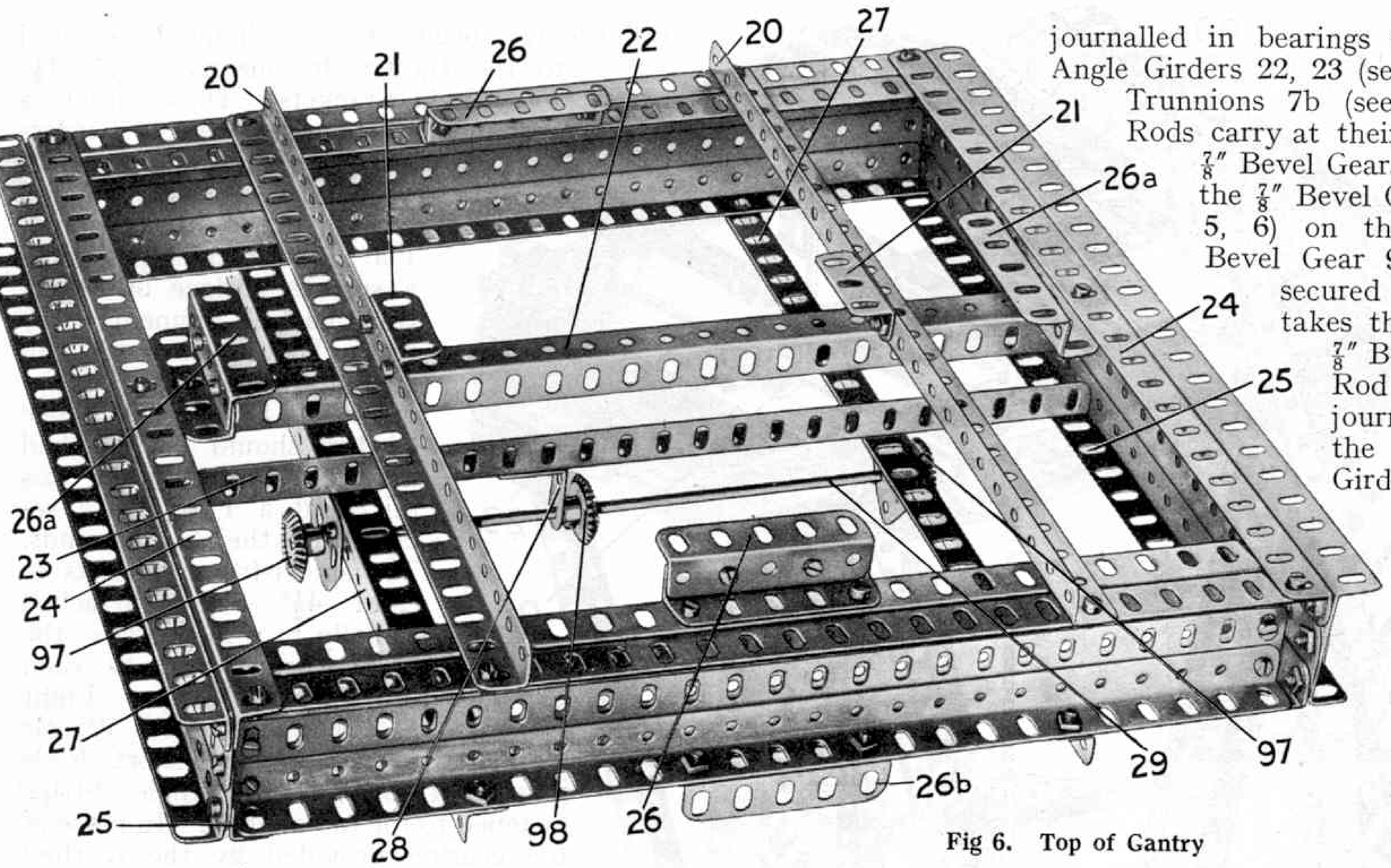


Fig 6. Top of Gantry

clearness. It gives a good view of the mechanism that operates the driving wheels, and also shows quite plainly the means by which the various units are fastened together. The 2″ Angle Girders 13 (Fig. 3, see last month's article) are bolted underneath the main composite girders of the top portion of the gantry (Fig. 8) and the Girders 10, 26b (see general view) are braced by two 9½″ Angle Girders 89 (Fig. 8). The Girders 5 of the bogies (see Fig. 9) are bolted to the outer sides of the Girders 10 on the gantry and the Girder Frames 4 to the Trunnions 14.

Each bogie is provided with two trailing and two driving wheels each made by butting together a Bush Wheel and a Flanged Wheel and securing them to the axle, which in the case of the trailing wheels is a 2″ Rod and in the case of the driving wheels a 2½″ Rod. The driving wheels are operated by ⅞″ Bevel Gears meshing with similar gears on the 3½″ Axle Rods 90, which are journalled in the Double Angle Strips 6 (see Fig. 9). A Washer is placed on each driving axle to keep the ⅞″ Bevel Gears in correct engagement.

Each of the Rods 90 is connected by a 2″ Rod 91 and two Universal Couplings 93 to a 1½″ Bevel Gear 94, secured to a 1½″ Axle Rod 92. The four Rods 92, to which the Bevels 94 are secured, are separate 1½″ Rods entering opposite sides of the Couplings 18: their other ends are journalled in the Flat Girders 15, and they are held in position by fixed Collars. The four Bevel Gears 94 engage with two ½″ Bevels secured to Rods that are journalled in bearings consisting of the Angle Girders 22, 23 (see Fig. 6) and the Trunnions 7b (see Fig. 3). These Rods carry at their upper ends two ⅞″ Bevel Gears 96 meshing with the ⅞″ Bevel Gears 97 (see Figs. 5, 6) on the Rod 29. The Bevel Gear 98, which is also secured to the Rod 29, takes the drive from the ⅞″ Bevel Gear 99 on a Rod 100 that is journalled in one of the top transverse Girders of the boom and in the centre bosses of the roller-bearing unit, and carries at its upper end a ⅞″ Bevel Gear 101 engaging with a similar wheel on the Rod 102, which is driven from an Electric Motor via the mechanism of the gear-box, and causes the four bogies to travel simultaneously along the rails. Hence the model is actually propelled by eight of its sixteen wheels.

The Roller Bearing (Fig. 7)

The large roller bearing, by means of which the boom of the crane is able to turn smoothly in any direction, may be purchased, together with the small toothed wheel, as a complete unit. The upper Geared Disc, which forms the movable race, is bolted to the

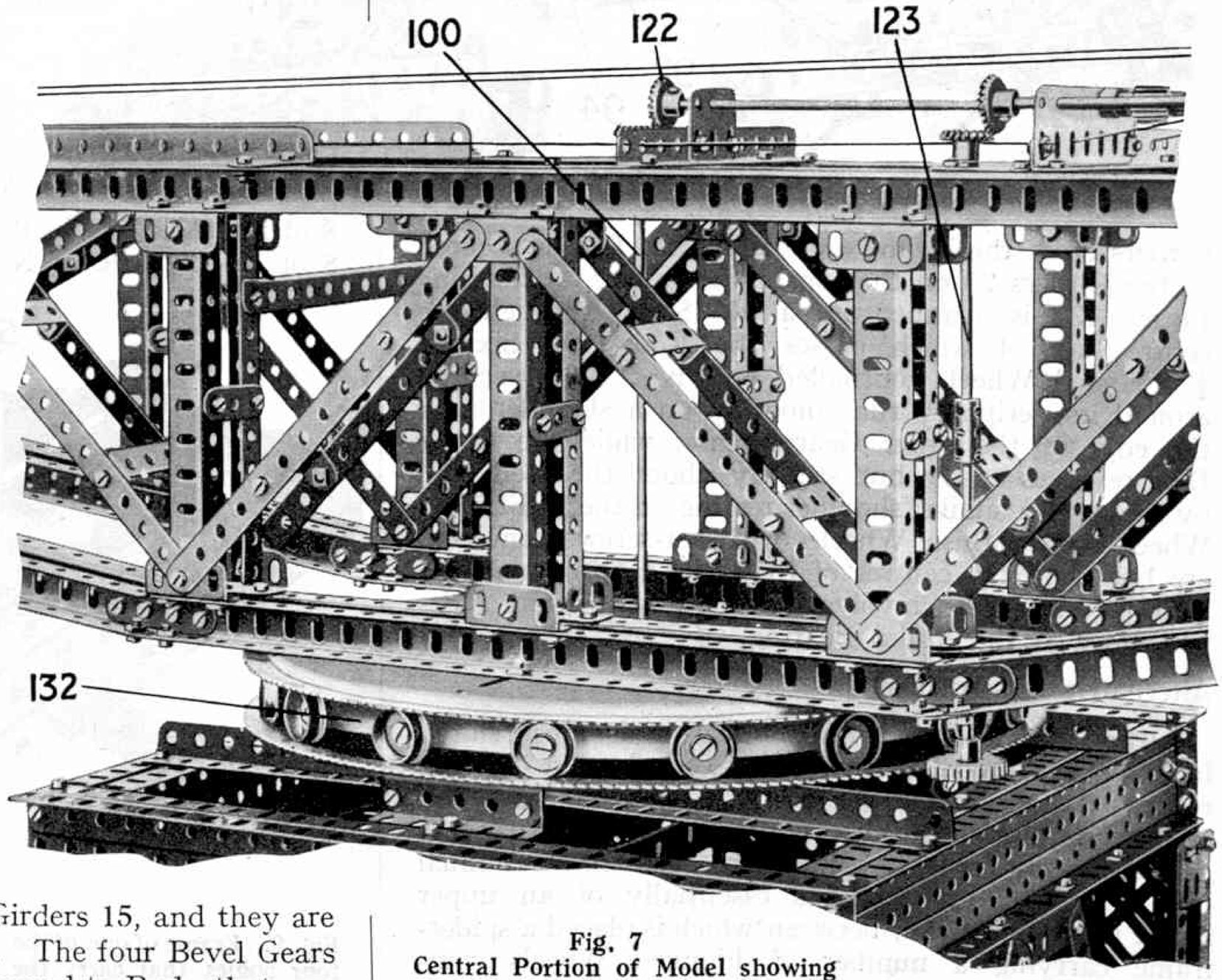


Fig. 7
Central Portion of Model showing roller bearings supporting the Boom

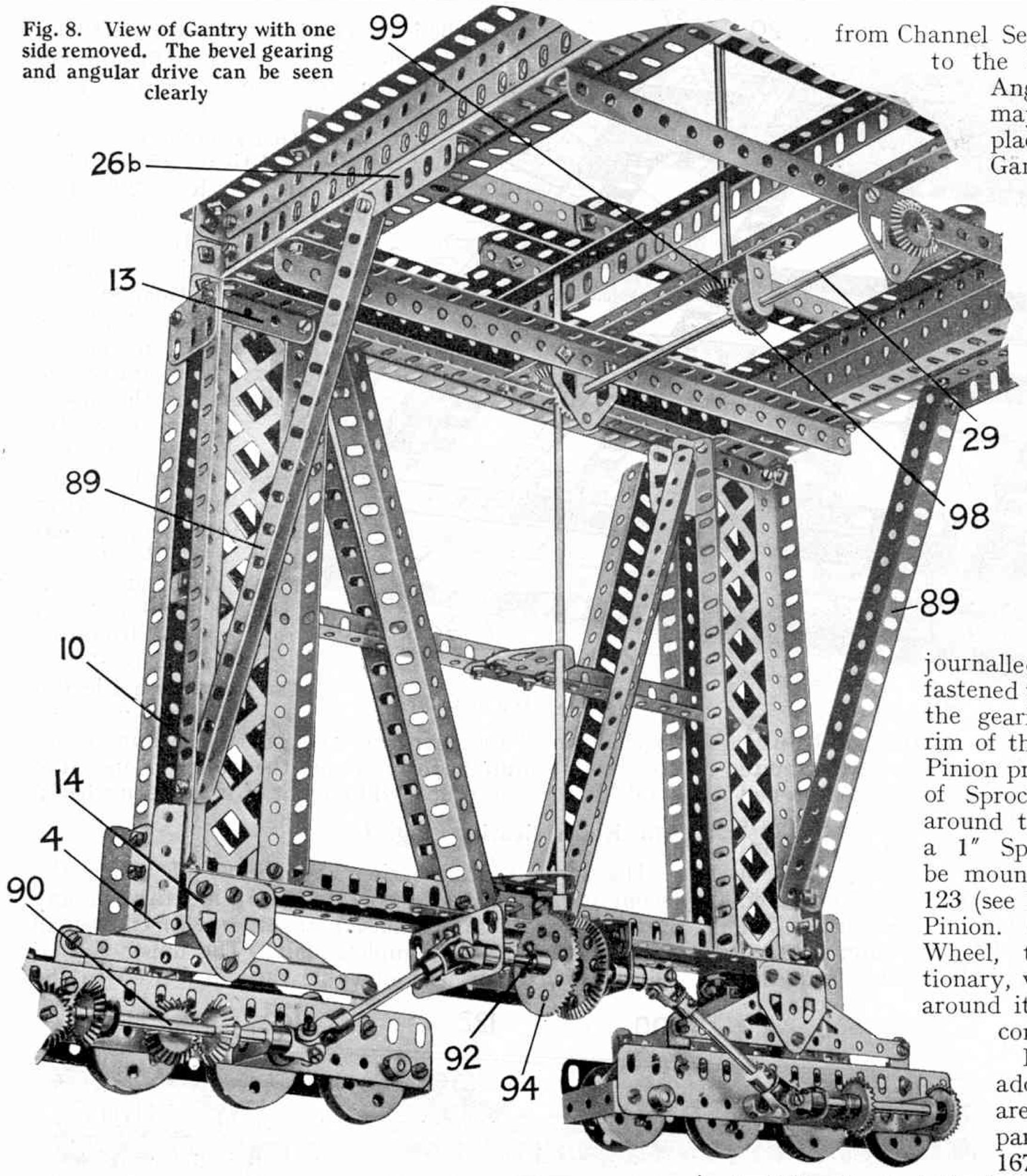


Fig. 8. View of Gantry with one side removed. The bevel gearing and angular drive can be seen clearly

Girders 35 of the boom, while the lower Disc is secured to the Girders 26 on the top of the gantry. The Ring Frame 132 is spanned by a $9\frac{1}{2}$" Strip, through the centre hole of which passes the Rod 100. Sixteen $\frac{3}{4}$" Flanged Wheels journalled on Pivot Bolts secured around its periphery run smoothly on a shoulder near the edge of the lower Geared Disc, while the upper Disc revolves easily but steadily about the Rod 100, by means of a similar shoulder resting on the $\frac{3}{4}$" Flanged Wheels. Two Bush Wheels, with set-screws removed, are bolted to the centres of the Geared Discs, and the Rod 100 is free to revolve in their bosses quite independently of the Roller Bearing.

Alternative Construction

Although the Geared Roller Bearing is most suited for use in this model, it is possible to construct a built-up roller bearing, similar in many respects to part No. 167, from standard Meccano parts. The bearing is described fully in the new Standard Mechanisms Manual (see S.M. 131) and consists essentially of an upper and a lower guide rail, between which is placed a spider-frame carrying a number of Flanged Wheels comprising the rollers. The lower guide rail is built-up from Channel Segments, and should be secured to the Gantry by means of $1" \times 1\frac{1}{2}"$ Angle Brackets. These Brackets may be bolted to Angle Girders placed flush with the top of the Gantry, but a better plan would be to fill in the entire top with Flat Plates, thus providing a smooth surface on which the Channel Segments may rest. The upper guide rail is composed of Channel Segments. Eight $4\frac{1}{2}$" Angle Girders should be attached in radial formation to this rail, and a Face Plate secured to their inner ends. The spider-frame consists of eight $4\frac{1}{2}$" Strips attached radially to a Face Plate, the Strips being held to each other by $3\frac{1}{2}$" Strips. Eight $1\frac{1}{8}$" diam. Flanged Wheels are secured to short Rods journalled in Double Angle Strips fastened to the radial arms. In place of the gearing provided by the toothed rim of the Roller Race and the special Pinion provided with this unit, a length of Sprocket Chain should be passed around the fixed guide rail, and over a 1" Sprocket Wheel, which should be mounted upon the composite Rod 123 (see Fig. 7) in place of the special Pinion. On rotation of the Sprocket Wheel, the Chain will remain stationary, whilst the Sprocket will travel around it, and the boom of the crane consequently rotated.

If this form of construction is adopted the following alterations are necessary to the list of parts required. For part No. 167 substitute :—8 of No. 2a ; 8 of No. 3 ; 8 of No. 9a ; 16 of No. 12b ; 8 of No. 16a ; 8 of No. 20 ; 76 of No. 37 ; 16 of No. 38 ; 8 of No. 48 ; 8 of No. 59 ; 3 ft. of No. 94 ; 2 of No. 109 ; 16 of No. 119 ; 8 of No. 125.

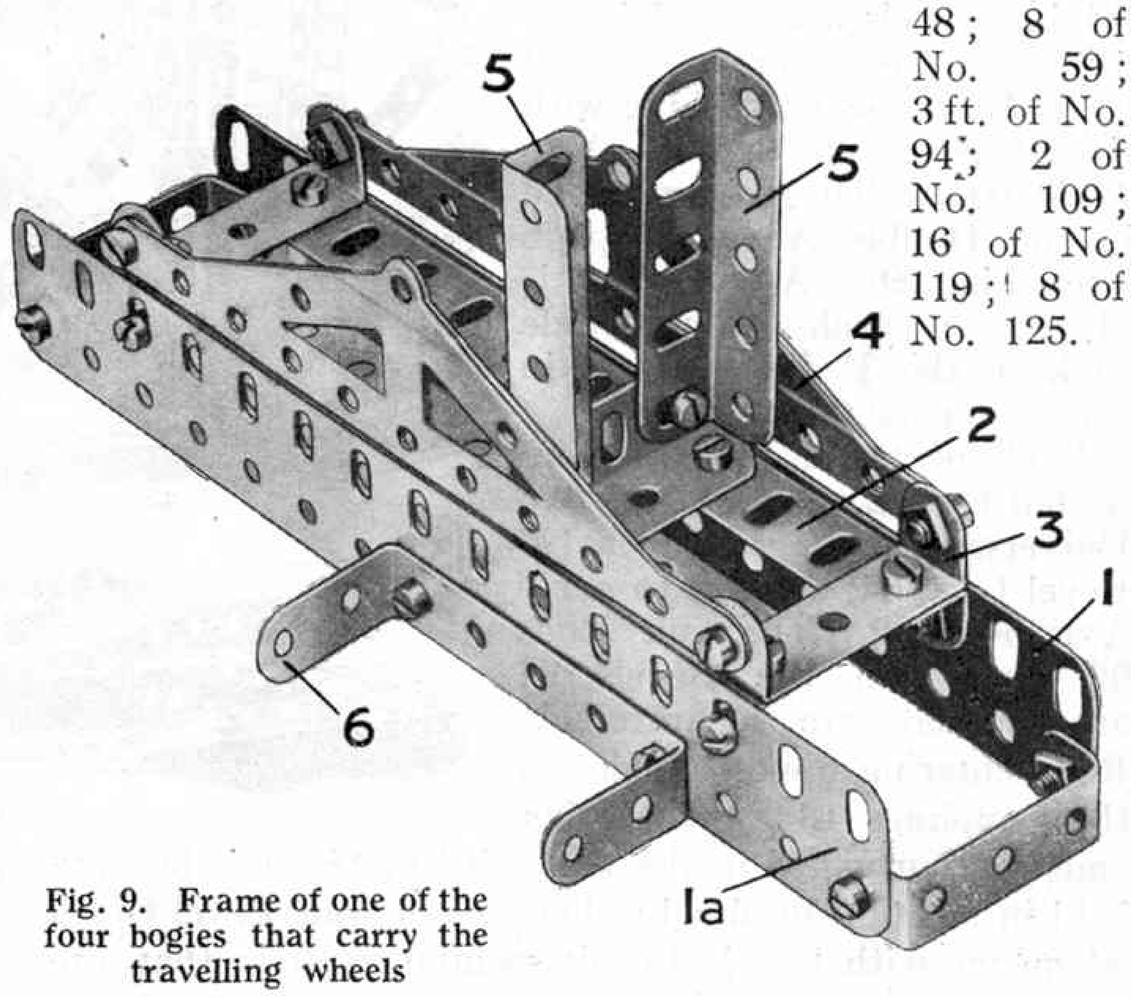


Fig. 9. Frame of one of the four bogies that carry the travelling wheels

Third "Lynx-Eye" Competition

A SPLENDID CONTEST FOR ALL MECCANO BOYS

MANY PRIZES GIVEN FOR SOLVING THESE PUZZLE PICTURES

ILLUSTRATED this month is a further set of twelve fragmentary pictures, comprising the third competition in "Lynx-Eye" series, the first and second contests having been announced previously in the April and May Magazines. For the benefit of those who have not seen the previous announcements we are again including full details together with one or two hints that will be found useful in solving these novel puzzle pictures.

The contests, we may mention, are proving a great success, model-builders finding the task of solving the puzzles a welcome change to actual constructional work.

If you have not entered either of the previous competitions, start solving this set of puzzles right away. You will be astonished to find how fascinating a task it is!

Next month we shall announce the final competition of the "Lynx-Eye" series, and readers who have entered the two previous contests should make a point of competing in both this and the final test, as we are offering three special prizes consisting of Meccano products to the value of £3/3s., £2/2s., and £1/1s., for competitors who succeed in solving the largest number of pictures in the complete series.

We regret that it is impossible to include the results of the Home Sections of the first "Lynx-Eye" Contest this month (the contest closed on the 30th April, 1929) as the Overseas section is still open and the publication of the correct list would give unfair advantage to readers residing Overseas. The results will, however, appear next month.

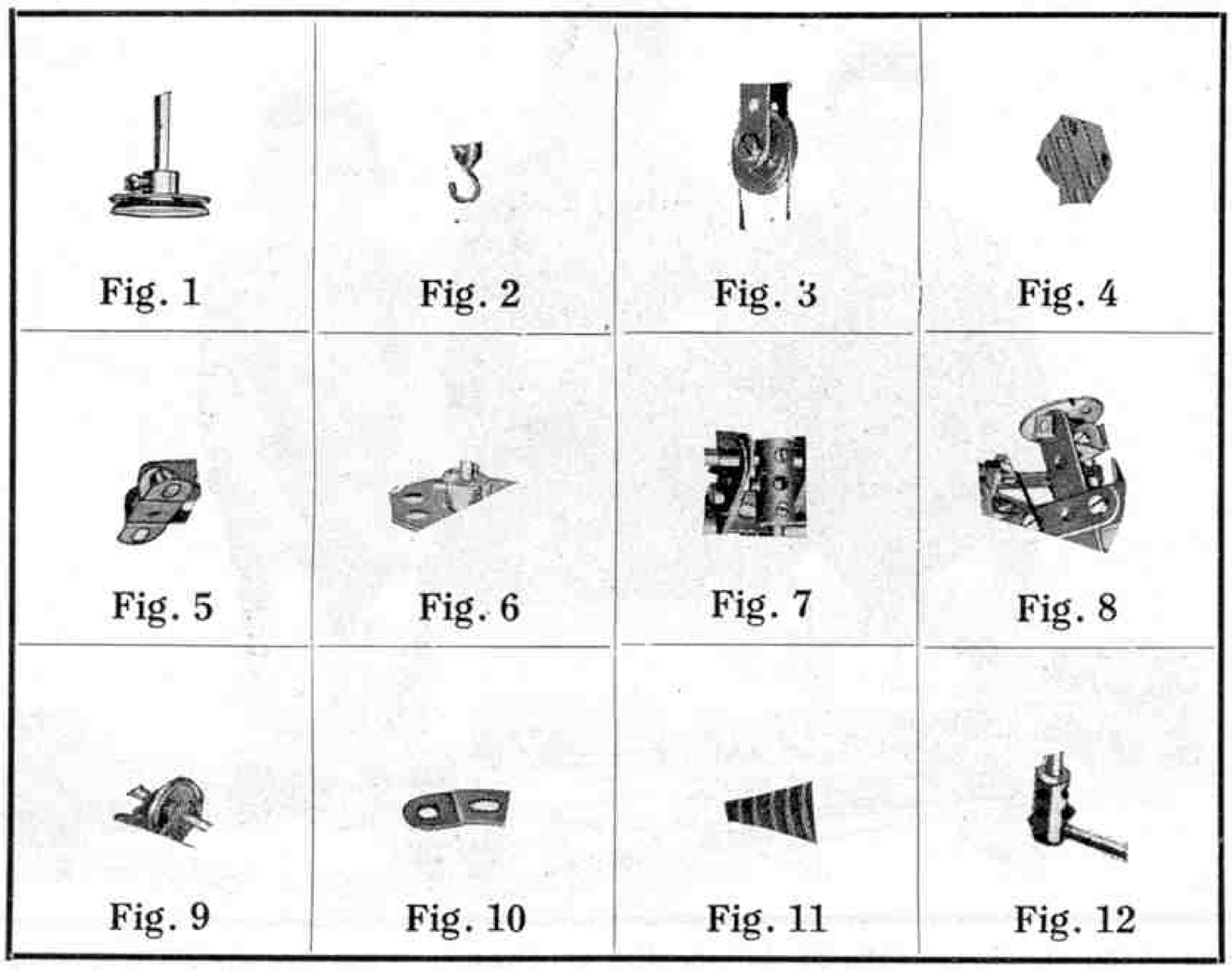


Fig. 1 — Fig. 2 — Fig. 3 — Fig. 4

Fig. 5 — Fig. 6 — Fig. 7 — Fig. 8

Fig. 9 — Fig. 10 — Fig. 11 — Fig. 12

What you have to do

Each of the twelve pictures illustrated in the centre of this page are fragments that have been cut from models shown in the 00-3 or 4-7 Manuals. What you have to do is to find out from which model each picture has been taken. This is not such a difficult task as it might at first appear, for by making a careful inspection of the separate Manual models you will soon be able to solve quite a number of the pictures.

The parts shown in the fragments will in nearly every case provide valuable clues in solving the puzzles. If, for instance, the picture shows part of a Coupling or Gear Wheel, the fragment could only have been taken from one of the larger models, while if the only parts shown are Strips and Pulley Wheels, it naturally follows that the fragments have been cut from very simple models. It should be mentioned that the fragments illustrated have not necessarily been printed in similar positions to those they occupy in the Manuals.

The contest will be divided into two sections—Section A for readers residing in the British Isles and Section B for readers residing Overseas.

The Prizes

The prizes that will be awarded in each section are as follows: First Prize, Meccano products to value £1/1s.; Second Prize, Meccano products to value 15/–; Third Prize, Meccano products to value 10/6; twelve copies of "Famous Trains" by C. J. Allen, and a number of other consolation prizes will also be awarded in each section.

Rules Governing Entry

In the event of more than one competitor solving all puzzles correctly, the prize will be awarded to the first entry examined. If no competitor succeeds in submitting a correct result, the prizes will be given to the entries containing the largest number of correct solutions.

As you solve each picture you should write down carefully on a postcard first the number of the picture and then the number of the model from which it is taken. The postcard must in addition contain your name, age, and full address, together with the Section in which you are entering. Address cards "Third Lynx-Eye" Contest, Meccano Ltd., Old Swan, Liverpool. Entries for Section A must reach this office not later than 29th June, 1929, and for Section B, not later than 31st August, 1929.

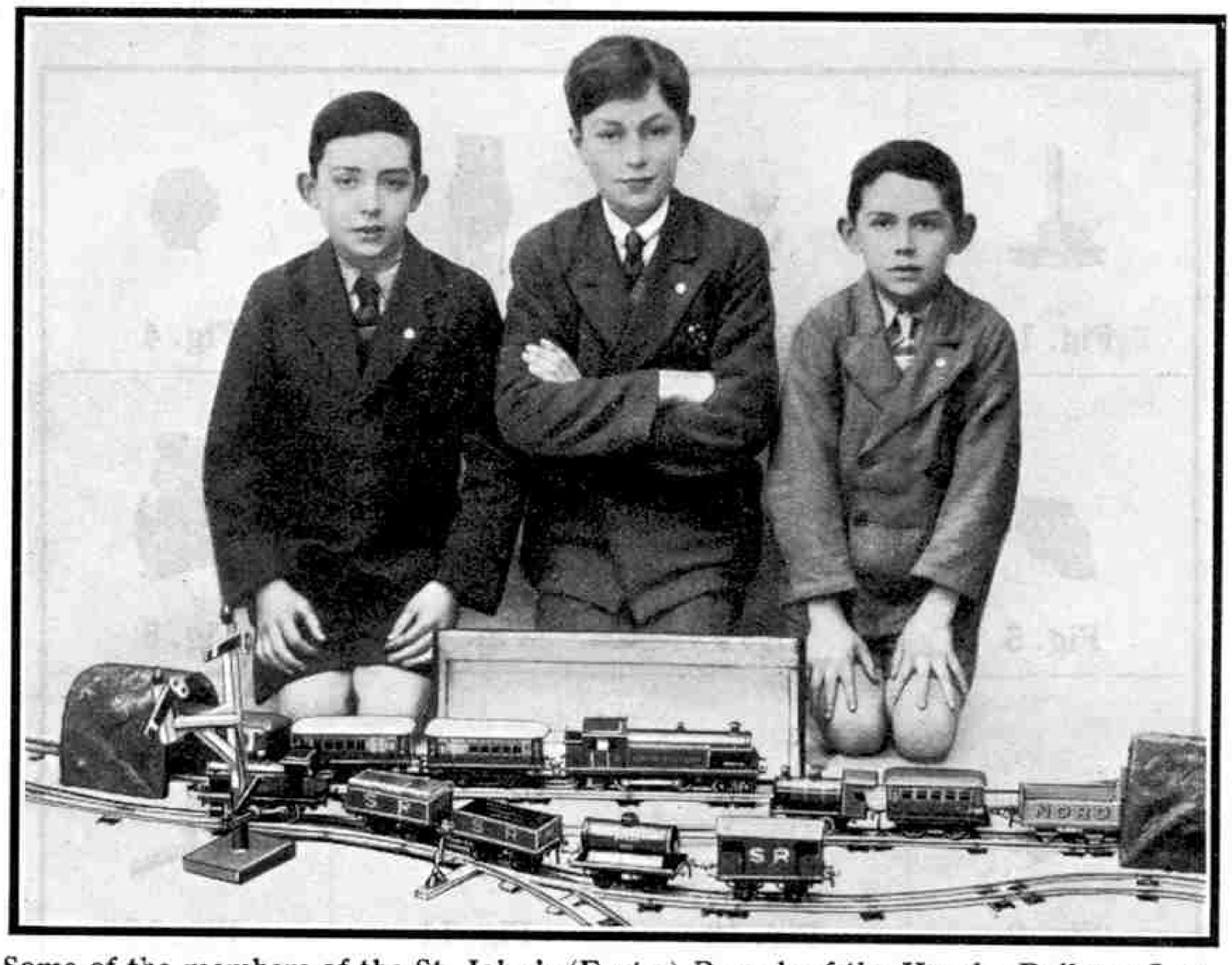


"Prowling Around!"

The majority of Branches now appear to be turning their attention largely to outdoor activities. In addition to games of various kinds and pre-arranged visits to places of interest, several Branches make a practice of having impromptu walks round and about the local railway line, stations, shunting yards, etc. One Branch secretary puts it: "We just prowl around, seeing all there is to be seen and doing our best to keep out of mischief!"

Sometimes these "prowlings" lead to a little bit of good fortune. For instance, some of the members of a Branch in the Midlands were watching with keen interest various shunting operations at the local L.M.S. sidings. Presently an engine drew up quite close to them. They stood watching it for a little while, and then the driver, seeing their keenness, began to talk to them, and finally asked them if they would like to have a look over the engine. Naturally the opportunity was pounced upon with enthusiasm!

I strongly advise H.R.C. members to endeavour to make the acquaintance of some of the local railwaymen. It has been my experience that the majority of railwaymen are keen on their jobs, and are always willing to have a chat with anyone who is really interested. In the course of conversations with drivers, firemen, signalmen and others, I have picked up many little tips and acquired curious little bits of information that otherwise I should have missed entirely. It is quite possible to obtain a sound knowledge of signalling, for instance, from books and railway magazines, but a chat with an experienced signalman seems to bring the whole thing to life; one seems as it were to obtain a new point of view from the inside. The same thing applies just as strongly, or even more so, in the case of a chat with a friendly engine driver.



Some of the members of the St. John's (Exeter) Branch of the Hornby Railway Company with part of the Branch's equipment. The centre boy Ronald Leyman is the Editor of a very interesting magazine produced by the Branch

A Sharp-eyed Young Railwayman

The mention of signalling reminds me that one Branch is practising bell signalling on similar lines to signal-box methods. This is an excellent scheme and one that might be developed very fully. The railway bell signalling code is not difficult to learn and operate, and a knowledge of it is decidedly useful. I recall an occasion when certain youthful railwaymen were assembled in a signalling school to undergo an examination. The examination was carried out with a miniature layout specially designed for the purpose, and perfectly equipped in every detail.

One of the youths was taking his turn, and a train under his control had just passed a signal-box when, to the astonishment of everyone, one of the other candidates suddenly stepped forward and gave nine consecutive rings of the bell. He had noticed something that had escaped the attention of everybody else in the room—the train had no tail lamp! This candidate was relieved from further examination on that occasion.

The Subscription Problem

I have received several requests from Branch secretaries for advice in regard to the subscriptions that should be paid by members. Unfortunately it is impossible for me to give any useful advice without knowing full details of local conditions. No two Branches are quite alike, and a scheme that is suitable for one might be utterly impossible for another. Perhaps the wisest plan is for the Chairman to fix a small subscription temporarily in order that the Branch may carry on, and subsequently make a careful estimate of the expenses that are incurred weekly or monthly. The subscription should then be adjusted so as to cover the expenses, with, if possible, a little over to meet any unexpected emergencies. I hope to say more on this matter next month.

Branch Notes

BELFAST.—Good progress is being made, and two well attended meetings were held during the past month. Mr. A. L. Pollock has been elected Chairman. Rules have been drawn up, and the membership subscription has been fixed at 2/6 per annum.

EXETER (POLSLOE).—The weekly meetings continue with unabated enthusiasm. The range of operations has been very greatly increased by the acquisition of Hornby double track.

EXETER (ST. JOHNS).—This Branch is now producing its own magazine, which is quite interesting, and shows signs of becoming a valuable feature. Forthcoming outdoor activities include a series of boat trips.

GLOUCESTER.—Mr. T. W. Clark, the Chairman, gave an interesting lecture on "*Railway Accidents*," and explained in detail the methods that are adopted in order to replace a locomotive on the track after derailment. Another very attractive lecture was given by the Foreman Boilersmith of the G.W.R. locomotive sheds at Gloucester. Taking for his subject "*Boilers and their construction*," he began with the steel plates, and passed in review all the different stages in the making of a boiler, and finally described how it is tested to ensure that it has an adequate margin of strength. A visit was paid to the G.W.R. shunting yard, on which occasion Mr. J. E. Gardner gave an interesting talk on "*Wagon Construction*," and illustrated his remarks by a demonstration with actual wagons.

KILMAURS.—Members are keenly enthusiastic about timetable working. Judging by the filled-in timetable forms sent in to Headquarters, they are working on excellent lines, and evidently have a thorough grasp of the principles.

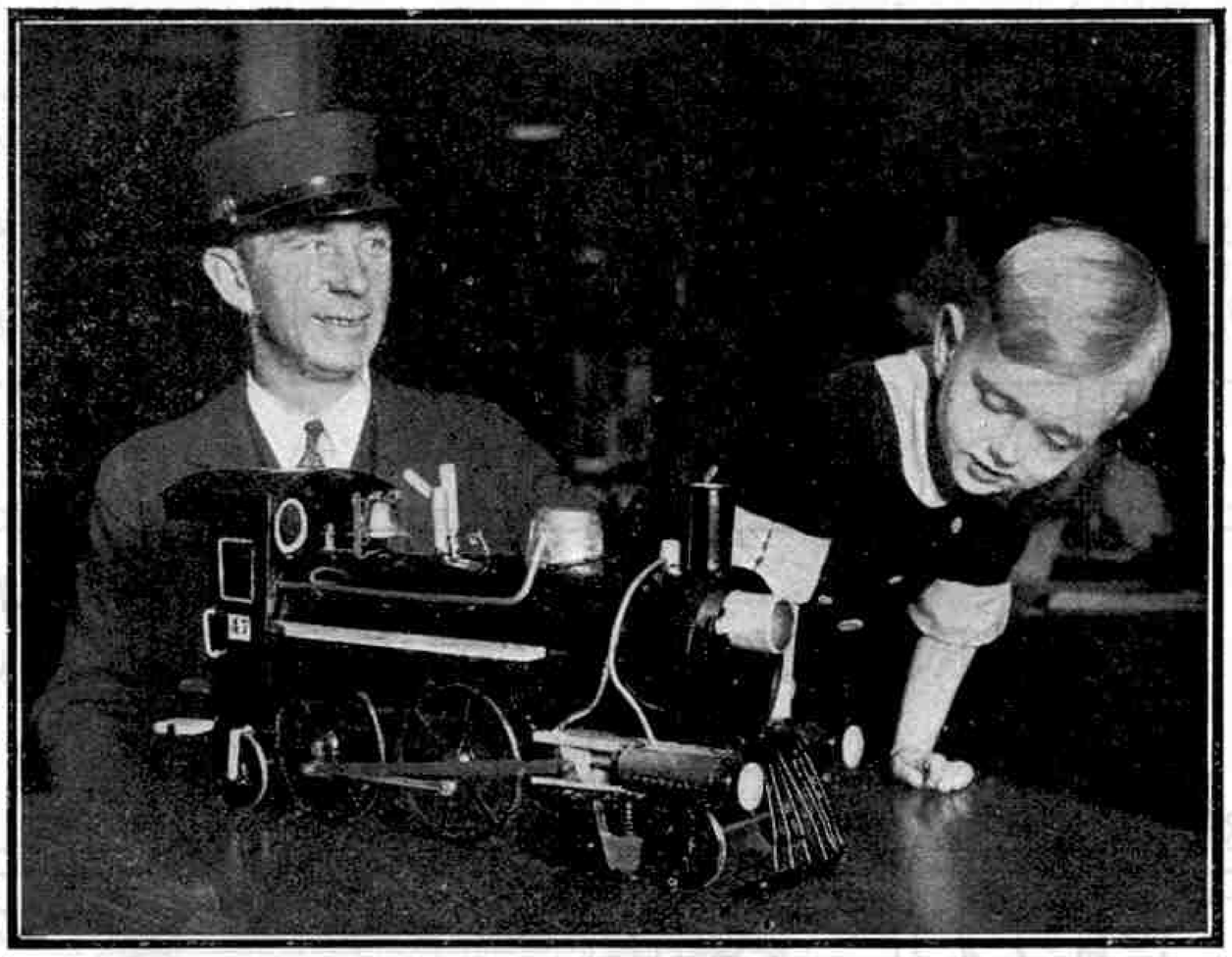
LENTON SANDS (NOTTINGHAM).—The leader, Mr. Whitby, has been compelled to resign, and Mr. Henson has been appointed leader in his place. In the course of a visit to the L.M.S. sidings some of the members were invited by a courteous driver to look over his engine, which proved to be one of the latest superheater goods engines.

MONTPELIER.—The membership is growing, and additional railway stock has been purchased. A recently-joined member has brought with him a good amount of railway material and this, added to the existing stock, has enabled a really first-class layout to be constructed. Half an hour is devoted at each meeting to reading, and members bring along any literature of railway interest that they are able to obtain.

PIXMORE.—During the month several outings have been carried through with great success. One of these was to Steeple Morden, on which occasion a very enjoyable day was spent in exploring the chalk pits. Forthcoming activities include comparative tests of locomotives, and a series of lectures on various railway topics of special interest.

PLYMOUTH (ST. BARTHOLOMEW'S).—This Branch now has a splendid double track 140 ft. in length, over which operations are carried out strictly to timetable. The track has been correctly signalled throughout, and no fewer than 21 engines are usually operated over it. A very promising magazine called "*The Gear Box*" has been started, and a very interesting visit has been paid to the Laira (Plymouth) Engine and Running Sheds.

BLACKPOOL NORTHERN.—Parents of members have been invited to visit the club and all have been very greatly pleased by the manner in which operations are conducted. The Branch now has two tracks. One of them is electrical, and on it trains are run in accordance with the timetable of a famous L.N.E. route, while the ordinary track is laid out to represent an equally well-known L.M.S. route.



The old fascination ! A locomotive of unorthodox construction, built up entirely from waste scraps of metal and wood

The members pay careful attention to timing, and a large wall-clock has been bought in order to ensure that trains are punctually despatched ! Another point of interest is that one evening per week is devoted to cleaning, repairing and renewing rolling stock, track and stations.

NEATH.—Members have been busily engaged in replacing all signals, which are now in good working order, and in constructing an additional siding. A Chief Locomotive Engineer's inspection coach has been made by one of the members, and has made many rapid runs behind a fast passenger express locomotive. Among places of interest visited have been two tunnels in the neighbourhood, the Neath Engine Sheds and the G.W.R. Telephone Exchange in Swansea.

SOUTH SHORE (BLACKPOOL).—Although efforts to obtain a permanent room have not yet been successful, members are so enthusiastic that they are meeting at their own houses, each in turn acting as host. The Branch is well stocked with locomotives, and the secretary spends most of his spare time arranging timetables for the very busy traffic ! A cricket team is being organised, and it is hoped to play many matches during the summer evenings.

Further H.R.C. Incorporated Branches

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications :—

BEXLEY—A. F. C. Harmer, "Ashleigh," Manor Way, Bexley, Kent.

BIRMINGHAM—P. J. Garland, 13, Woodland Road, Northfield, Birmingham.

BOOTLE—P. Hughes, 39, Sidney Road, Bootle, Liverpool.

COVENTRY—R. Hawthorn, 61, Berkeley Road, Earlsdon, Coventry.

HORLEY—N. H. Parfitt, Westfield Cottage, Horley, Surrey.

LONDON, S.W.2 — J. F. Morton, 17, Ostade Road, Brixton Hill, London, S.W.2.

LONDON, N.W.11.—J. Menhinick, "Treguddick," 31, Gresham Gardens, Golders Green.

MADELEY—Bernard J. Sims, "Prospect House," Madeley, Nr. Crewe.

ST. NEOTS—L. G. Flanders, Bedford Street, St. Neots, Hunts.

TILEHURST—C. M. Whiteley, "Hill Top," Westwood Road, Tilehurst, Reading.

WALSALL—P. Richardson, "Woodford," Jesson Lane, Walsall, Staffs.

WITHAM—A. Lucking, 49, Bridge Street, Witham, Essex.

WOODFORD WELLS—J. H. Shelt, "Walberswick," Woodside Road, Woodford Wells, Essex.

WYMONDHAM—A. H. Williams, School House, Spooner Row, Wymondham, Norfolk.

OVERSEAS

ARGENTINA—J. V. Warr, Matheu 184, San Martin, F.C.C.A. Argentina.

CAIRO—M. H. Bali, 1, Haret El Wazzan, Darb El Gamamiz, Cairo.

INDIA—P. C. Manchanda, "Ramour," 2 Mozang Road, Lahore, India.

SOUTH AFRICA—L. Creasey, "Elsinore," Mount Pleasant, Simonstown, S.A.

Further Branches in Course of Formation

37. PLYMOUTH (ST. BARTHOLOMEW'S)—K. Wills, 8, Beechwood Avenue, Mutley, Plymouth.
38. SHREWSBURY CENTRAL—Mr. E. Acton Philpott, 4, John Street, Shrewsbury.
39. SOUTH SHORE (BLACKPOOL).—R. V. Bentley, 9, Bamton Avenue, Watsons Road, Blackpool.
40. FIRST WALLASEY—Harry Collard, 7, Birkenhead Road, Wallasey, Cheshire.
41. STROUD GREEN—J. Summers, 214, Stapleton Hall Road, Stroud Green, N.4.
42. BOWDON—P. E. Arnold, "Lynton," Wood Lane, Timperley, Cheshire.



VIII.—LIFTING BRIDGES AND SAFETY GATES

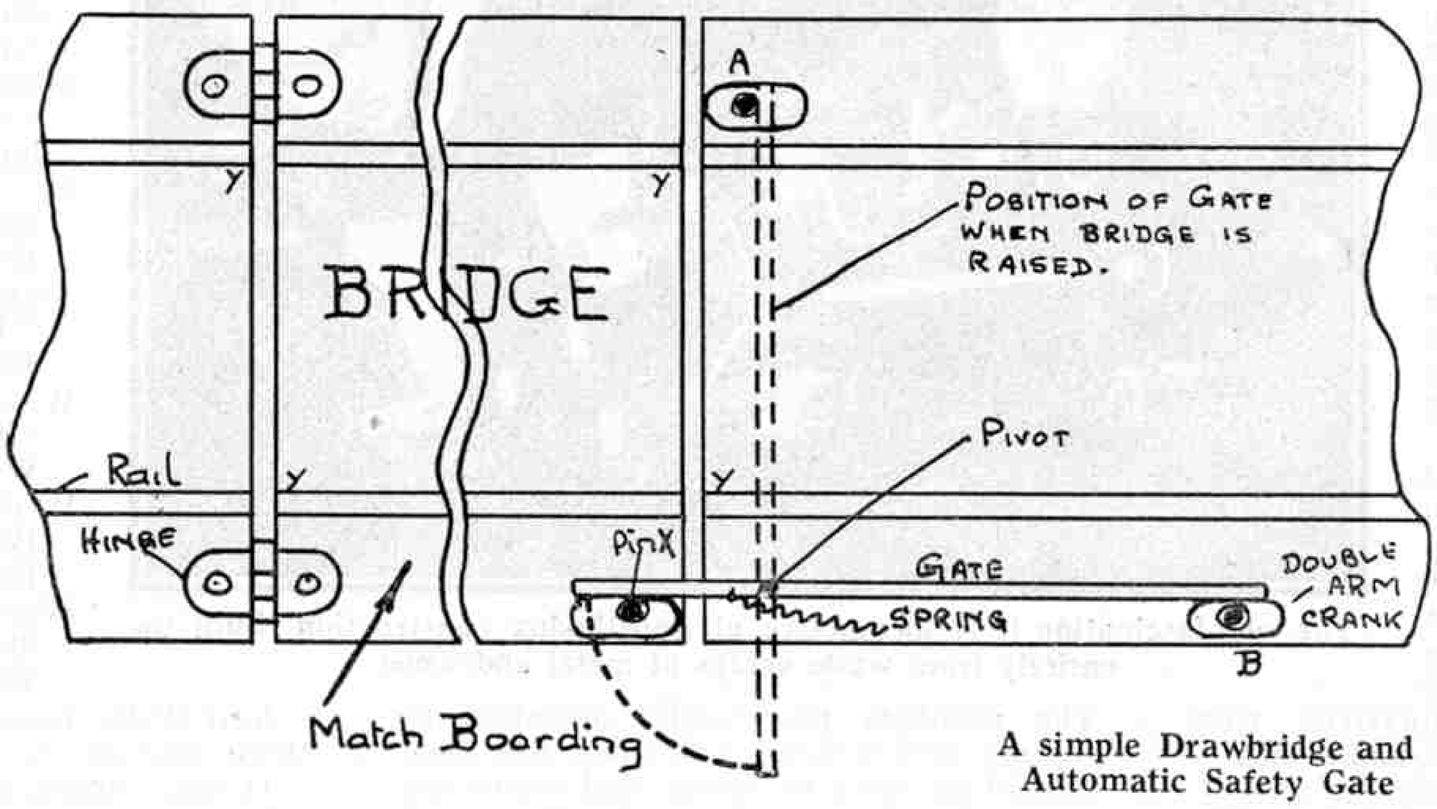
ALTHOUGH the majority of H.R.C. members are obliged to be content with a layout that has to be put down and taken up each time it is used, there are many fortunate ones who have at their disposal an attic or other spare room that can be devoted almost entirely to model railway purposes. When this is possible the track is usually laid on plank shelves running round the room, or on a large table in the middle of the room. Frequently the two are combined. The shelf track gives a splendid continuous main line run, while the table provides the necessary space for the layout of one or more stations complete with engine sidings, goods sidings, turntable, etc.

In the case of a shelf track round the room, this generally consists of smoothly planed planks supported either on trestles or on some kind of brackets fixed to the wall. With this arrangement it will be found necessary to make provision for opening the door of the room, and as a general rule this is most easily carried out by means of a lifting bridge. The introduction of a bridge of this type, however, brings with it the danger that unless the operator and his friends are extremely careful, trains may meet with disaster owing to the bridge being left open at the wrong moment, thus leaving a gap in the track. Although no lives are at stake, a fall of this kind is, of course, extremely bad for the engine, and may result in very serious damage.

Several H.R.C. enthusiasts have encountered this difficulty, and in response to many requests we describe this month an automatic safety gate which, if properly made and installed, will be found of great assistance. This gate is primarily intended to bring a train to a standstill in case the bridge has been left open, and it does this very efficiently.

The gate may be constructed from almost any kind of material, but Meccano Angle Girders and 12" Strips will be found the most useful of all. As will be seen from the diagram the gate is so pivoted that one end when open, swings out over the bridge, and thus prevents this from being raised until the gate is closed, thus ensuring a continuous track.

The action of the device is as follows. The movement of the gate is limited in either direction by stops (A) and (B) as shown. The gate is provided with a strong spring, which normally tends to close it, that is, to keep the gate across the track; and the only way in which it can be kept open is by inserting the pin (X) in a hole provided in the bridge. It will thus be seen that when the bridge is raised there is nowhere to insert the pin and the gate must therefore remain closed unless held open by hand, so that it is impossible for the position of the gate to be overlooked.



A simple Drawbridge and Automatic Safety Gate

This type of gate has stopped, without injury, heavy model passenger trains travelling at full speed. In a modified form the motion of the gate may also be utilised to operate a signal arm, stop catch, or in the case of an electric railway, an electrical cut-out for the track. If any readers carry out experiments in this direction we should be very glad to hear of the results, as we think there are great possibilities with such mechanisms.

The gate proper would, of course, have to be pivotally supported so as to lie across the track when the bridge is raised. Care must be taken to ensure that the pivot is placed in such a position that one end of the gate overhangs the edge of the bridge when the gate is thrown open to allow the passage of a train. A Meccano Spring will be found quite powerful enough to hold the gate closed, when it is released by removing the stop "X" from the hole. The "stop" could consist of a Meccano Threaded Pin placed in the boss of a Double Arm Crank secured to the floor of the bridge.

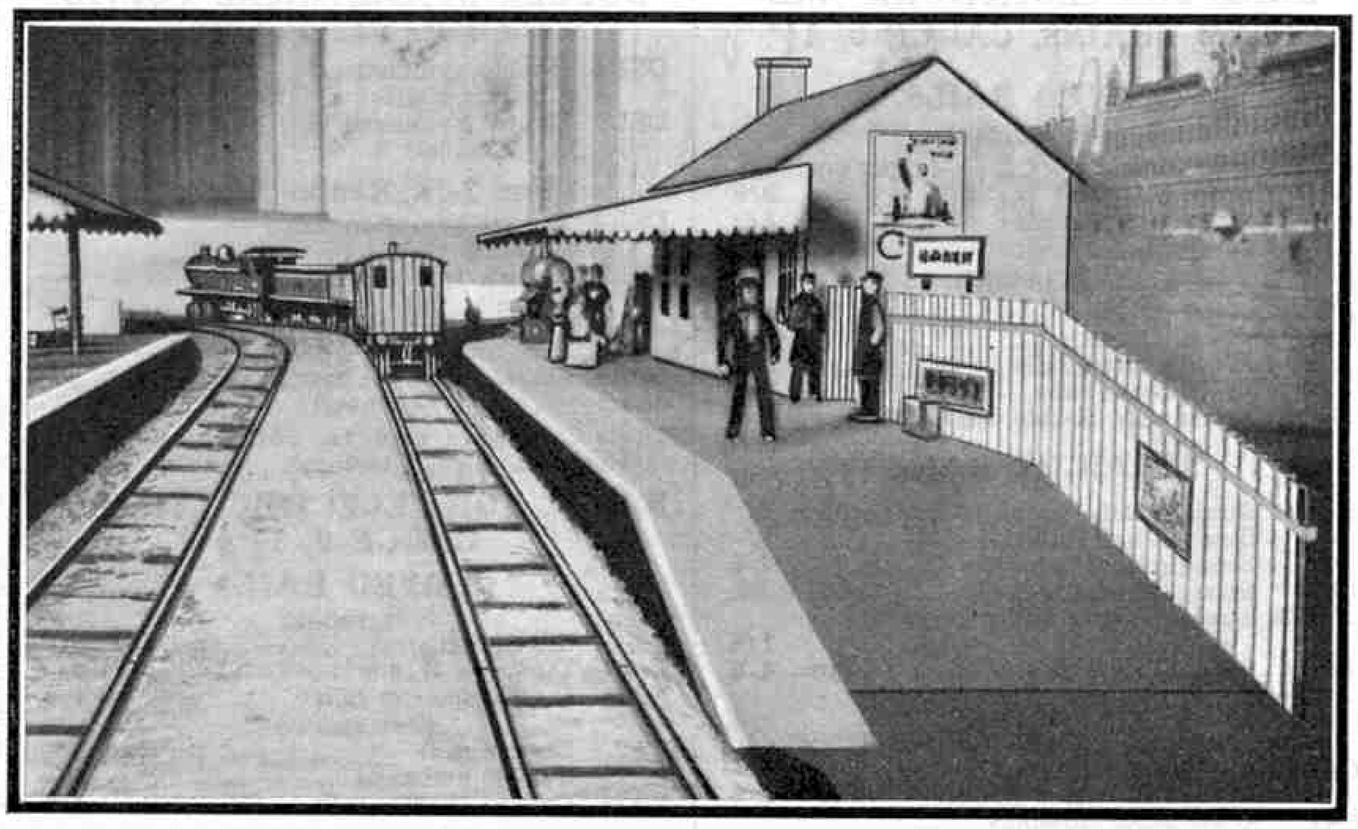
The lifting bridge itself could be made out of ordinary matchboarding, the length of which depends, of course, on the width of the doorway. For the purpose of joining the bridge to the trestles or planks on which the remainder of the track is laid, strong iron hinges are most satisfactory. The portion of the track that crosses the lifting bridge should be screwed down firmly and it

will, of course, be necessary to extract the connecting pins from the rails at the points " Y " so that the bridge can be lowered to the correct position to bring the two portions of track flush with each other.

Layouts that are Worth a Trial

As the result of our recent article on continuous and non-continuous layouts, several H.R.C. members have written to ask for further suggestions. We therefore illustrate this month two further layouts.

The first, Fig. 1, is a simple non-continuous plan that is capable of very considerable development by the addition of sidings and one or more branch lines. The length of run is, of course, dependent upon the space available and the distance that the locomotives in use will haul a train on one winding. Nothing is more aggravating than to see an engine slow up and come to a standstill with its train halfway round the track. The only way to avoid this is to make the distance between the terminal stations such that the engines will traverse it once, twice, or more times on one winding, with a margin to spare sufficient to allow trains to be shunted out of the way on to the loop line if required. Another advantage of this layout is that by placing the two stations close together the whole of the working may be carried out by one operator, but of course the fun is vastly increased if two or more operators are engaged.



An interesting model station layout submitted by C. McLean, Ayr, N.B. A very realistic effect is created by the figures on the platform

The other layout, Fig. 2, is useful in obtaining a satisfactory length of run between terminal stations in a small room. Here the stations are outside the oval, and a train starting from either of them may be sent round the continuous line as many times as desired, and then run into the other terminus. This layout developed to the limits of space available is in many respects one of the best for a small room. Here again, one operator can operate the layout if absolutely necessary.

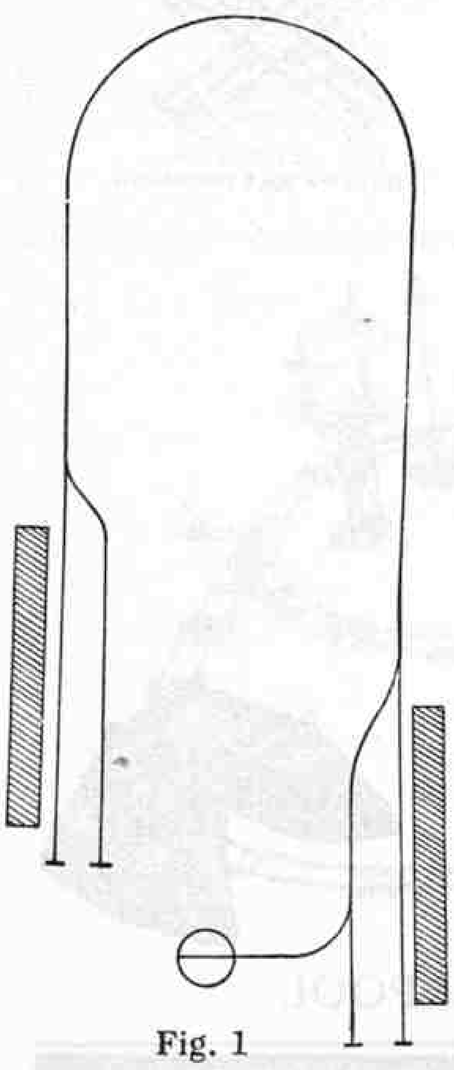


Fig. 1

A Semi-Permanent Track Suggestion

The continual laying down and taking up of tinplate rails imposes considerable strain upon them. This cannot altogether be avoided, but the following suggestion should prove helpful.

Obtain from the nearest timber dealer several sheets of cheap plywood, rather less than $\frac{3}{8}$ in. in thickness. Thus, instead of laying the rails on the floor in the ordinary way, cut the plywood into strips about 6 in. wide to fit under the track. The rails may now be screwed down to the wood, and this will permit the owner to take up the layout in sections without danger of bending or otherwise damaging the rails. Sections of track about 5 ft. long will be found most convenient for taking up and storing.

Stations, goods yards, etc., may be mounted on separate pieces of wood cut to the proper size, and by carefully planning the breaks between the different sections of track, it is possible to build a very efficient semi-permanent and yet easily portable layout that can be taken up in sections in a very few minutes.

If it can be avoided, it is not advisable to screw down the track directly to the baseboard. If this is done, steadiness of running is immediately obtained, but this deteriorates by degrees. Probably the best method is to rest the sleepers on small pieces of felt, and then screw the track down.

The small felt buffers absorb most of the shocks and stresses of running, and at the same time give a perfectly steady track. The adoption of this idea has the further advantage of greatly reducing the noise of running, which in some cases is quite an important matter.

The foregoing method of fixing the track has also an important bearing on the problem of locomotive driving wheel-slip. It will be found that on such a track locomotives are much less liable to slip than on a track improperly or carelessly laid down, and if in addition the track can be ballasted, the wheel-slip trouble should disappear almost entirely.

Obviously, of course, skidding is bound to occur if the rails are not kept perfectly clean from dirt and rust, and above all from oil or grease of any kind. Model railway owners appear to adopt quite a variety of methods of cleaning the rails, but experience shows that there is nothing more effective than an occasional good rub over with a rag soaked in petrol. This treatment should be applied also to the treads of the wheels of the rolling stock.

Petrol also is of very great value in cleaning the mechanism of a model locomotive that has become clogged up with old oil and dust, and is running sluggishly.

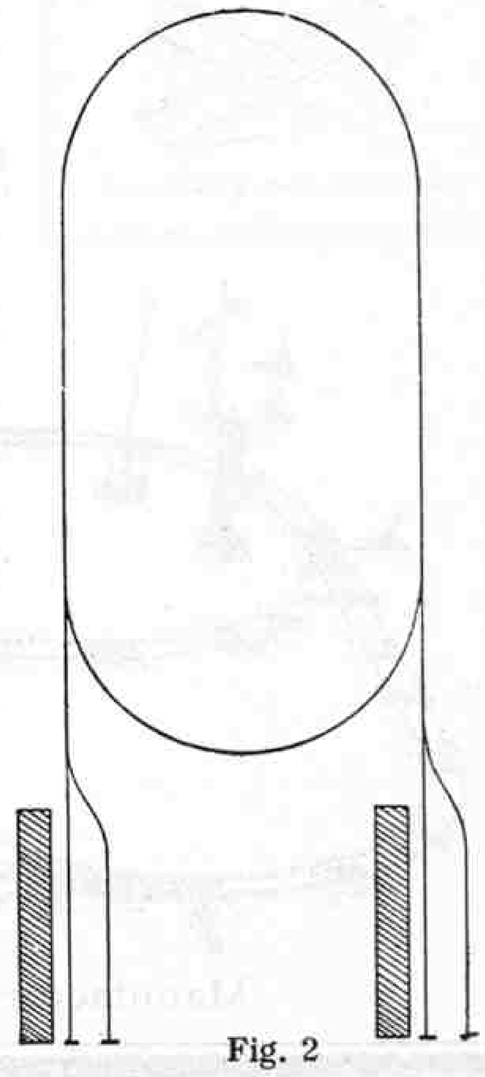
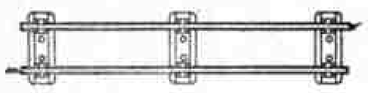
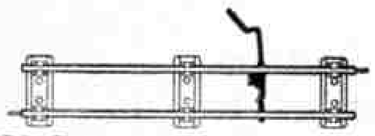
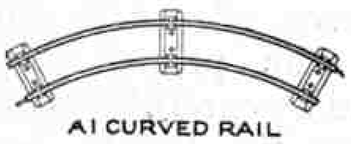


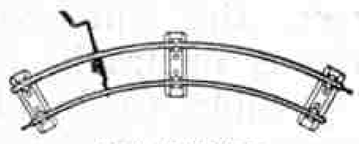
Fig. 2

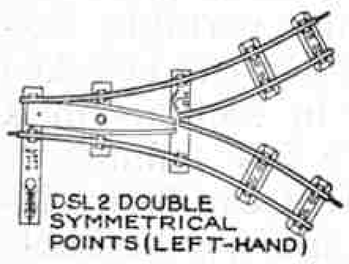
Hornby Rails, Points and Crossings

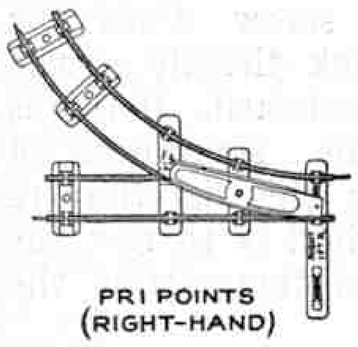

B1 STRAIGHT RAIL

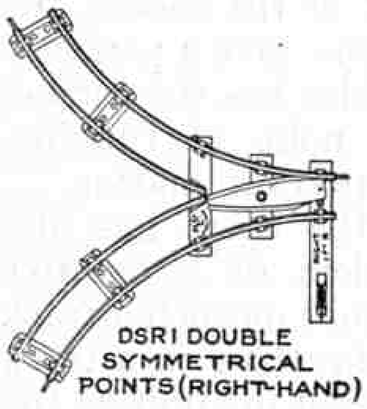

BB1 STRAIGHT BRAKE RAIL

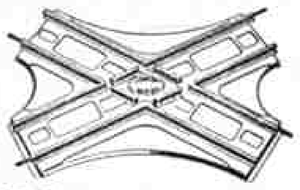

A1 CURVED RAIL


AB1 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


CA1 ACUTE-ANGLE CROSSING

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. An almost endless number of realistic and railway-like layouts can be constructed with them. Only the finest materials obtainable are used in their manufacture. They are rigid, strong and durable and will give every satisfaction.

RAILS FOR CLOCKWORK AND STEAM TRAINS, GAUGE 0, 1¼″

CURVED RAILS

(1-ft. radius)

A1	Curved rails	... per doz.	4/6
A1½	Curved half rails ...	... „	3/6
A1¼	Curved quarter rails	... „	3/–
AB1	Curved brake rails ...	... each	6d.

(2-ft. radius)

A2	Curved rails	... per doz.	4/6
A2½	Curved half rails ...	... „	3/6
A2¼	Curved quarter rails	... „	3/–
AB2	Curved brake rails ...	... each	6d.
DC2	Curved rails, double track	½ doz.	5/–

STRAIGHT RAILS

B1	Straight rails ...	... per doz.	4/–
B½	Straight half rails ...	... „	3/–
B¼	Straight quarter rails	... „	2/6
BB1	Straight brake rails	... each	5d.
BBR1	Straight brake and reverse rails	... „	1/6
DS1	Straight rails, double track	½ doz.	4/6

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	1/6
CA2	Acute-angle crossings (for 2-ft. radius tracks) ...	„	1/6
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	1/6
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/6

POINTS

For 1-ft. Radius Curves

PR1	Right-hand points	per pair	4/–
PL1	Left-hand points		

For 2-ft. Radius Curves

PR2	Right-hand points	per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base, with ground disc and lamp, and adapted for Hornby control, right hand	per pair	7/6
PSL2	Points on solid base, with ground disc and lamp, and adapted for Hornby control, left hand		

PARALLEL POINTS

For 2-ft. Radius Curves

PPR2	Parallel points, right	per pair	5/–
PPL2	Parallel points, left		
RCP	Rail Connecting Plates ...	½ doz.	4d.

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double symmetrical points, right	per pair	5/–
DSL1	Double symmetrical points, left		

For 2-ft. Radius Curves

DSR2	Double symmetrical points, right	per pair	5/–
DSL2	Double symmetrical points, left		

CROSSOVERS

COR2	Crossovers, right hand	per pair	12/–
COL2	„ left hand		

These Crossovers may be obtained fitted for Hornby Control if required, price 12/- pair

RAILS FOR ELECTRIC TRAINS. GAUGE 0, 1¼″

CURVED RAILS

(1-ft. radius)

EA1	Curved rails ...	... per doz.	8/–
EA1½	Curved half rails ...	... „	5/–
EA1¼	Curved quarter rails	... „	4/6

(2-ft. radius)

EA2	Curved rails ...	... per doz.	8/–
EA2½	Curved half rails ...	... „	5/–
EA2¼	Curved quarter rails	... „	4/6

STRAIGHT RAILS

EB1	Straight rails ...	... per doz.	7/–
EB½	Straight half rails ...	... „	4/6
EB¼	Straight quarter rails	... „	4/–

POINTS

For 2-ft. Radius Curves

EPR2	Right-hand points	per pair	10/–
EPL2	Left-hand points		

CROSSINGS

ECA	Acute-angle crossings ...	each	4/–
ECR	Right-angle crossings ...	„	4/–

DOUBLE SYMMETRICAL POINTS

For 2-ft. Radius Curves

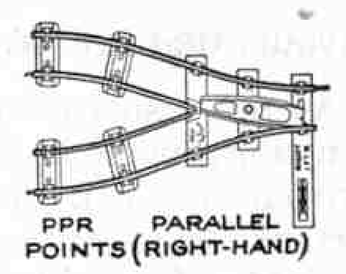
EDSR2	Double symmetrical points, right	per pair	12/–
EDSL2	Double symmetrical points, left		

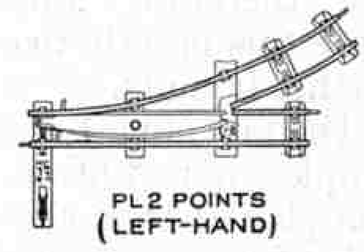
PARALLEL POINTS

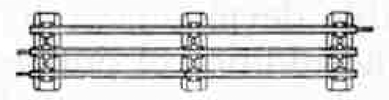
EPPR2	Parallel points, right	per pair	12/–
EPPL2	Parallel points, left		
TCPL	Terminal Connecting Plates (low voltage)	each	1/6
TCPH	Terminal Connecting Plates (high voltage)	„	1/6

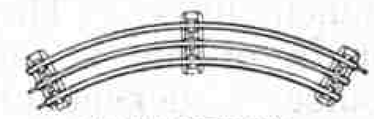
Electrical Points for 1-ft. radius curves are not supplied.

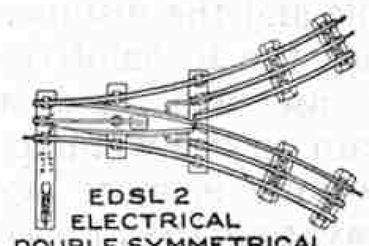
The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many similar illustrations and much useful information is given in a booklet entitled "How to get more fun out of Hornby Trains." This booklet is obtainable from your dealer, price 3d., or from Meccano Ltd., Old Swan, Liverpool, price 3d. post free.

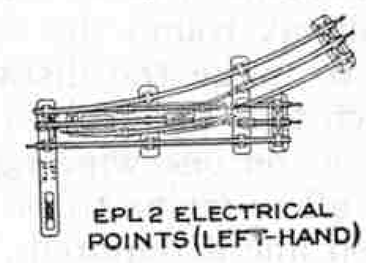

PPR PARALLEL POINTS (RIGHT-HAND)

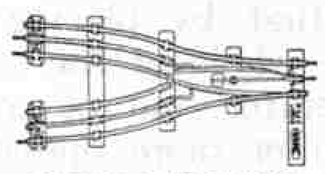

PL2 POINTS (LEFT-HAND)

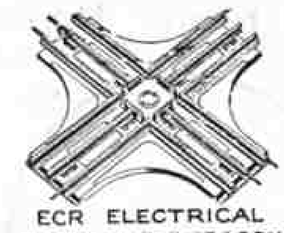

EB1 ELECTRICAL STRAIGHT RAIL

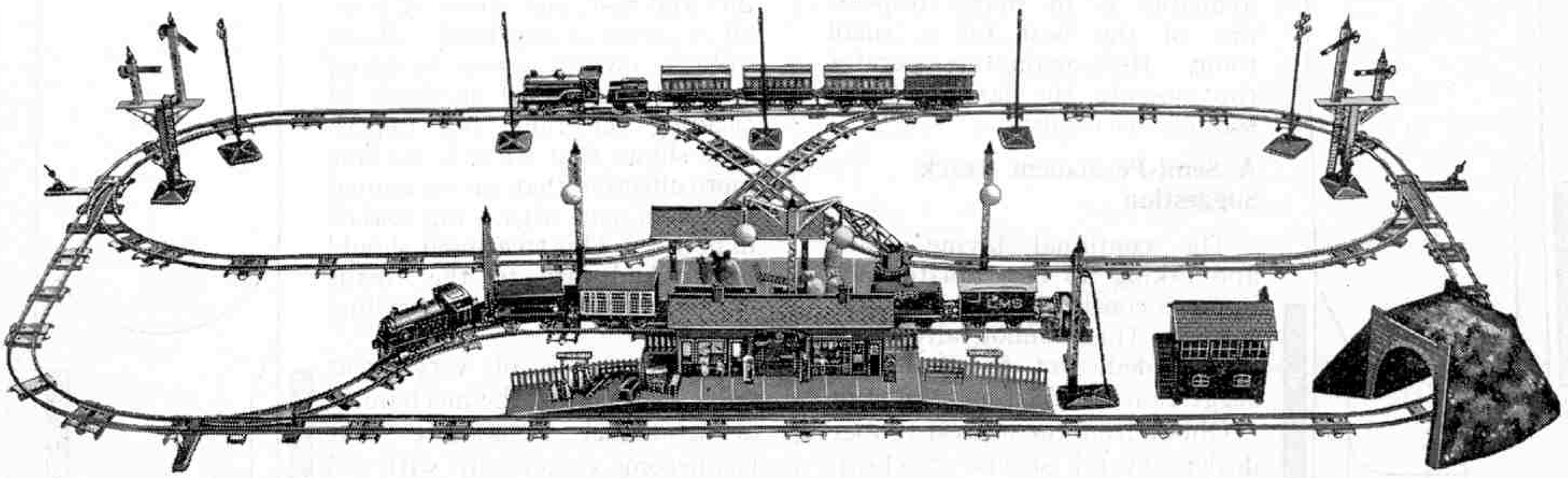

EA1 ELECTRICAL CURVED RAIL


EDSL2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


EPL2 ELECTRICAL POINTS (LEFT-HAND)


EPPR2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)


ECR ELECTRICAL RIGHT-ANGLE CROSSING

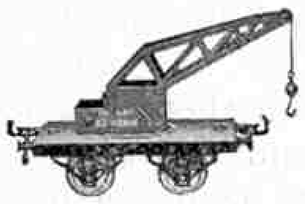


Manufactured by MECCANO LIMITED - OLD SWAN - LIVERPOOL

Rolling Stock of the Hornby Series

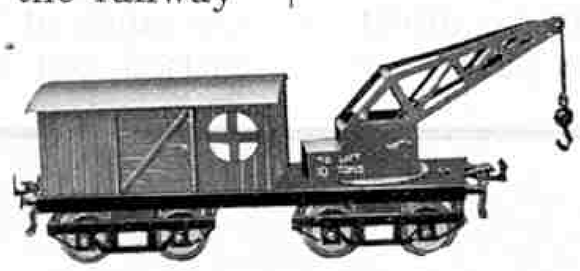
By 'Tommy Dodd'

CONTINUING my survey of the rolling stock of the Hornby System, I will deal first of all with the Breakdown Van and Crane. This is a reproduction of a travelling appliance that is used on actual railways for the very important task of clearing the track of debris after an accident. Frequently the mishap is nothing more serious than a derailment, but however trifling it may be the engine is put out of action for the time being and the line is obstructed. The ever-ready breakdown crane then has to be requisitioned to restore normal working conditions.



CRANE TRUCK

In this country railway mishaps are rare, thanks to the highly efficient operating systems of the railway companies and the skill and care of their staffs. When an accident does occur, however, one of the earliest steps taken is to report it by telephone, or any other means available, to certain specified points, including the nearest locomotive depot, where a complete breakdown train is always kept in readiness to proceed at the shortest notice to any part of the district. The breakdown train's mission is to secure a clear line, and special orders at the scene of the mishap allow it to proceed on the wrong road if necessary.



BREAKDOWN VAN AND CRANE

A breakdown train usually consists of an engine and tender followed by the travelling crane; a van containing chains and wire ropes of every variety; a van in which the train crew travel, and a tool van containing the various miscellaneous appliances required. These include hydraulic jacks capable of lifting as much as 30 tons, screw jacks, and various appliances for relaying damaged tracks. For work at night oil flares and acetylene lamps are carried.

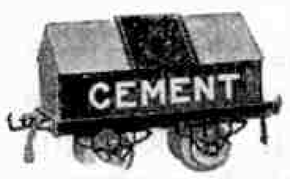


TROLLEY WAGON

The Hornby Breakdown Crane is mounted on two four-wheeled bogies, and the crane is of the swivelling type. It is provided with mechanism for hoisting and lowering loads, so that the model may be put to actual work. The van portion is fitted with opening side doors.

The general appearance of the model is very handsome and it adds enormously to the realistic appearance of a layout. It should be noticed that it is not suitable for curves of less than 2 ft. radius.

Another interesting Hornby unit of a somewhat similar type is the Crane Truck. This is a very useful vehicle and is exceptionally handy for loading and unloading open wagons. On actual railways crane trucks are often to be seen in the vicinity of timber operations, as they are very largely employed for loading logs on to the timber wagons.



CEMENT WAGON

Sometimes very heavy or bulky loads have to be transported by rail, and for this purpose the Hornby Series includes a strongly built vehicle known as the Trolley Wagon. From the illustration on this page it will be seen that the long, low construction of this wagon offers ample facilities for fixing a bulky load in position, an important point being that only a very small lift is necessitated when loading The centre of gravity in a wagon of this type is kept as low as possible in order to prevent the setting up of the excessive oscillation that otherwise would be liable to result when very heavy loads were being carried. The wagon is fitted with special stanchions, bolsters and chains by means of which the load is secured to the chassis.



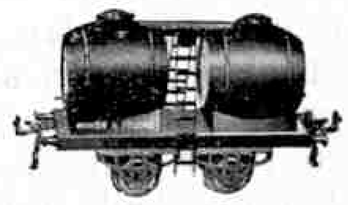
PETROL TANK WAGON "SHELL"

Fairly common objects in various parts of this country are the special wagons used for the transportation of cement. In actual practice cement wagons are usually of the closed type and have a hinged lid fitted so that the wagon may be loaded from a chute down which the cement is tipped from the mill. This method of loading necessitates placing the lid of the wagon in a sloping position. The Hornby Cement Wagon has all the typical features of the real vehicle and is very strongly constructed.

We now come to a series of vehicles very commonly seen on almost every section of railway in this country—namely wagons for the conveyance of petrol. Owing to the exceedingly inflammable nature of petrol these wagons need to be very strongly constructed to ensure that there is no possible chance of leakage occurring that might lead to disastrous fires and explosions.

Most of the big petroleum firms possess their own rolling stock lettered and coloured to their own specification. There is, however, a strong family resemblance between them all. They consist of a large cylindrical tank fitted with a special kind of manhole and cover and mounted on a heavily built chassis. The tank is filled from the manhole and when full the cover is placed in position and secured in such a manner that it is impossible for any leakage or evaporation to take place. Owing to their dangerous character petrol wagons are usually placed towards the rear of a train so that they are well out of the path of flying sparks from the engine. The Hornby Series includes three examples of this type of wagon, lettered and coloured to represent "B.P.," "Shell," and "Pratts" vehicles respectively.

Our next example is a type of wagon unfamiliar in this country, but very common in France and other wine-producing countries. This is the Wine Wagon, numbers of which are to be seen working in the neighbourhood of vineyards. The Hornby model consists of two barrel tanks mounted on a strong underframe. The provision of two tanks enables two kinds of wine to be carried and has the advantage of dividing the load more evenly over the wheel axles.



WINE WAGON



MEMBERS OF THE H.R.C ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

JUNIOR SECTION

VI.—Train Formation

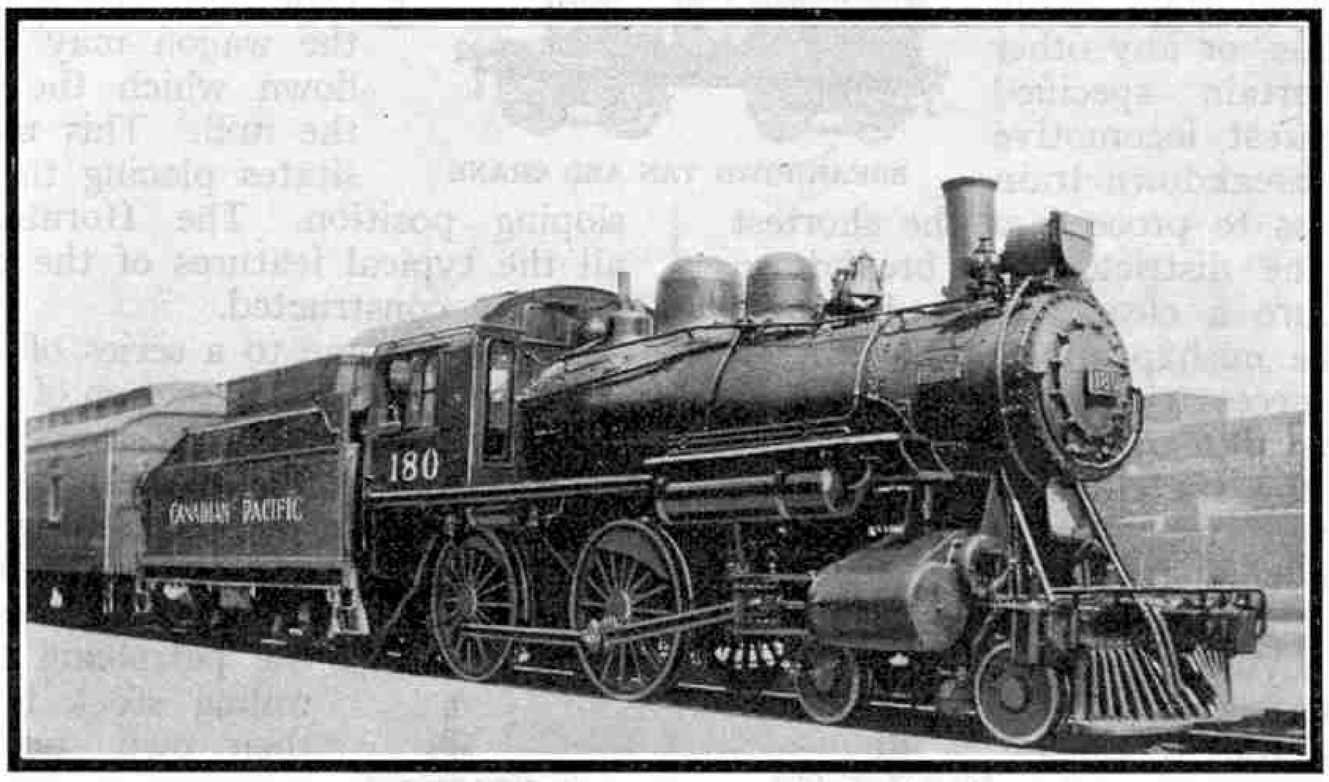


MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

THE subject of train formation has been mentioned briefly in these pages from time to time, and as there appears to be a very general interest in this branch of model railway working we propose this month to deal with it in more detail.

First of all it should be pointed out that in order to obtain the best results the layout must be one capable of dealing with a good flow of traffic, particularly at the terminal stations. As far as possible these stations should be arranged so that all routes are independent of one another. That is to say, there should be direct access to the main lines from each of the passenger platforms. The position of goods sidings and goods yards also should be studied carefully from the point of view of accessibility.

It is not easy to give any general rules on this matter as conditions vary so greatly in different layouts. The guiding principle, however, is to arrange the sidings so that trains may be broken up and reformed with the smallest possible number of engine movements. The reduction of engine movements to the minimum is quite an interesting study, and it is surprising how often a small alteration to a layout will simplify working operations.



An excellent photograph sent in by a Canadian reader, Alan Wilde of Galt, Ontario. The locomotive is of the 4-4-0 type, and has been in service on the C.P.R. since 1885

Having disposed of these preliminaries we will consider first the formation of passenger trains. The making-up of a passenger train should be done on a siding, as is the case in actual railway practice. If this is not possible the operations should be carried out on a loop line in the station. It is here that the small 0–4–0 tank engine comes in useful, and one of these engines is capable of carrying out some very realistic shunting. As the distances to be covered by the shunter are very short, it is a good plan not to wind it to the full, in order to check its speed a little, especially when starting away with a light load. Every endeavour should be made to carry out all operations by means of an engine. It is decidedly unrailwaylike, for instance, to lift Pullman cars about by hand! Very frequently a hand operation that appears to be inevitable may be done away with by a slight revision of the arrangement of the approaches to the platforms or sidings.

Shunting operations are made very much easier by the use of the Hornby Shunter's Pole. This is specially designed for coupling and uncoupling, and its slender proportions make the process quite simple. Once the knack of using this pole has been mastered there is no reason for the unrealistic method of hand operation.

First attempts at making-up a train by means of an engine are apt to result in a good deal of confusion. A little practice makes a wonderful difference, however, and it is great fun to try to see how quickly a particular operation can be completed. It is unwise to attempt too much at the commencement, and a simple operation carried out quickly and neatly is far more satisfactory than a more complicated one muddled through.

In making up passenger trains, or indeed trains of any kind, great care should be taken to complete the train with an appropriate guard's van. In Pullman expresses a composite coach should be placed at each end of the train.

Care should be taken to avoid making up a train of too great a length. This does not look any more realistic than a shorter train, and is liable to introduce complications. In regard to the weight of the train there is more scope, and as a matter of fact a heavy train runs far better than a light one. This weight may be obtained by lengthening the train, but this is far less satisfactory than increasing the weight of a train of moderate length by fitting Mansell wheels to some of the coaches. These wheels improve the running of any train to a very great degree.

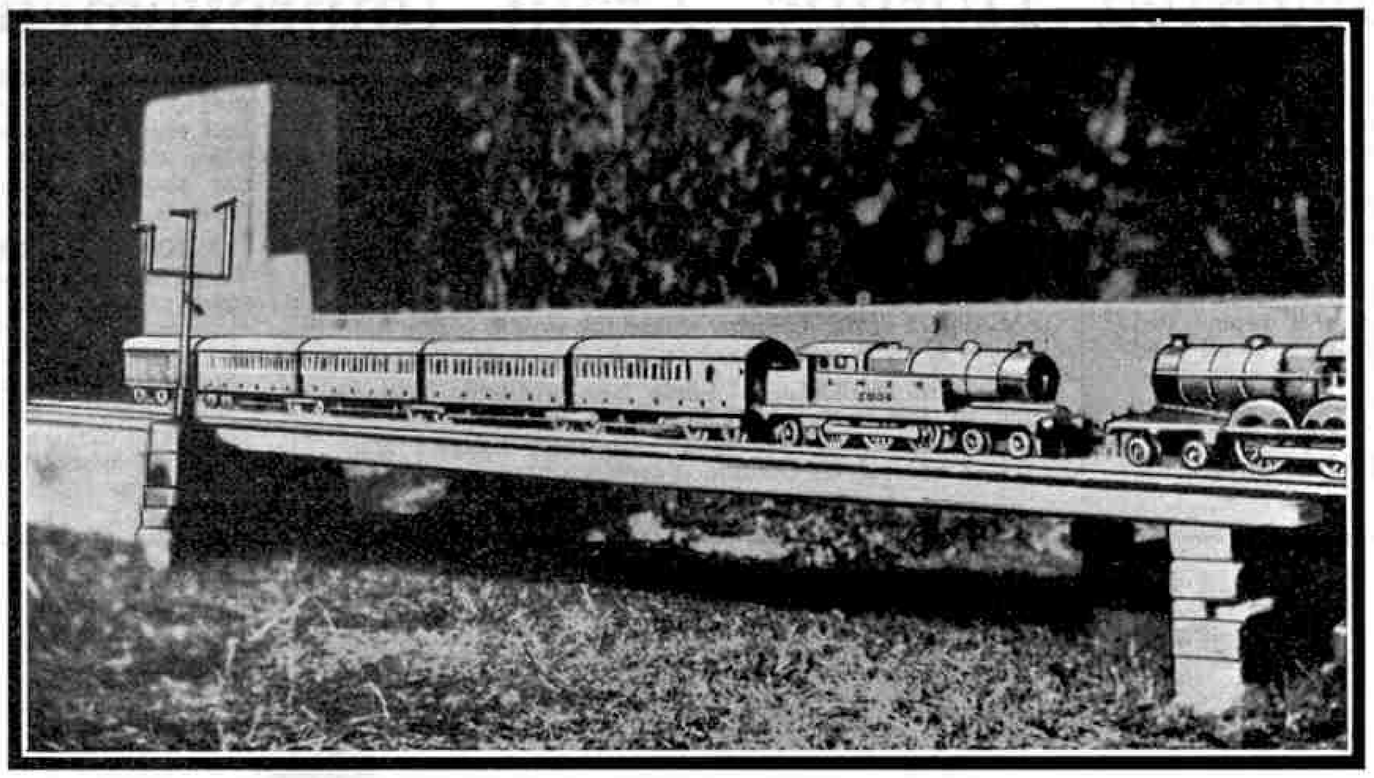
Many Hornby train users appear never to try "double-heading" their trains. This can be carried out without any difficulty, however, and it gives a unique touch of realism to any train. We advise all H.R.C. members to try this for themselves.

Certain goods, by reason of their perishable nature, require to be transported to their destination with the utmost possible speed. For this reason milk vans, for instance, may often be seen incorporated in express passenger trains. In such a make-up it is very important that the milk vans should be easily taken off from the train at the required point and to facilitate this they are placed either at the front or at the rear of the train. Two or three milk traffic vans added in this manner

to a passenger train give a very realistic appearance, besides affording variety in shunting operations.

Only a comparatively small number of milk vans can be dealt with in this way, however, and milk trains, that is trains composed entirely of milk vans, play a very important part in railway practice. A train made up of Hornby Milk Traffic Vans looks exceedingly realistic. These vans are very attractive in appearance and the four milk cans with which they are equipped give a businesslike appearance to the vehicles.

Coming now to goods trains of the "mixed" variety, the Hornby rolling stock provides an extremely wide range of vans and wagons. An interesting mixed train may be made up of an open wagon, a luggage van, two or three lumber wagons, another open wagon and a brake van. Such a train is very attractive in appearance and gives full scope for ingenuity in making-up. This train is, of course, only mentioned as a suggestion, for the possibilities are almost unlimited. Generally speaking, greater realism will be obtained if the trucks of each type are distributed along the train than if all vehicles of one type are grouped together. Finally, the brake van should never be omitted.



Some of the fine cardboard rolling stock constructed by M. B. Flanders as part of the equipment for his model railway. An article describing this railway appeared in last month's issue

Wagons containing material of a dangerous character —gas cylinder wagons or gunpowder vans—should not be mixed up, but each type should be kept separate. On a mixed train also, petrol wagons should be kept together, as in real railway practice consignments of petrol usually necessitate five or six tank wagons coupled together.

The long train of empty open trucks, which we will suppose to be returning to the mines, should also be borne in mind. As a matter of fact these wagons are so neat in appearance that a long train of them looks exceedingly effective and very like the "real thing" so common on actual railways.

A very interesting plan is to pay a visit to the local goods yard or station and make notes of any unusual or specially interesting train formation with a view to reproducing it in Hornby material. In addition it is possible to obtain some really good tips in regard to making-up a train by watching the movements in a fair sized yard. The whole object is to get each van or wagon to its proper place with the least possible number of engine movements, while at the same time avoiding interfering with, or "trapping" any other vehicle. In actual practice the making-up of a long and varied goods train is a highly skilled operation, and one that requires long experience.

Very realistic shunting operations may be carried out by the method known as "fly-shunting," especially if the layout includes a section having a number of points branching from one line. This method of shunting saves the time that normally would be occupied by the engine in going with the train up the siding and back again. In the fly-shunting method it is necessary to have points facing the engine and leading to the sidings. Two trucks should be coupled together in front of the engine, but not attached to it.

The sequence of operations is as follows. The engine is set in motion so as to travel towards the points. Just before reaching the points the engine is stopped suddenly, with the result that the trucks fly on by themselves into the siding. It will be found useful to employ a brake rail for bringing the locomotive to a standstill sufficiently quickly. By this method it is possible to "sort" quite a number of trucks without any necessity for the engine itself to enter any of the sidings during the process.

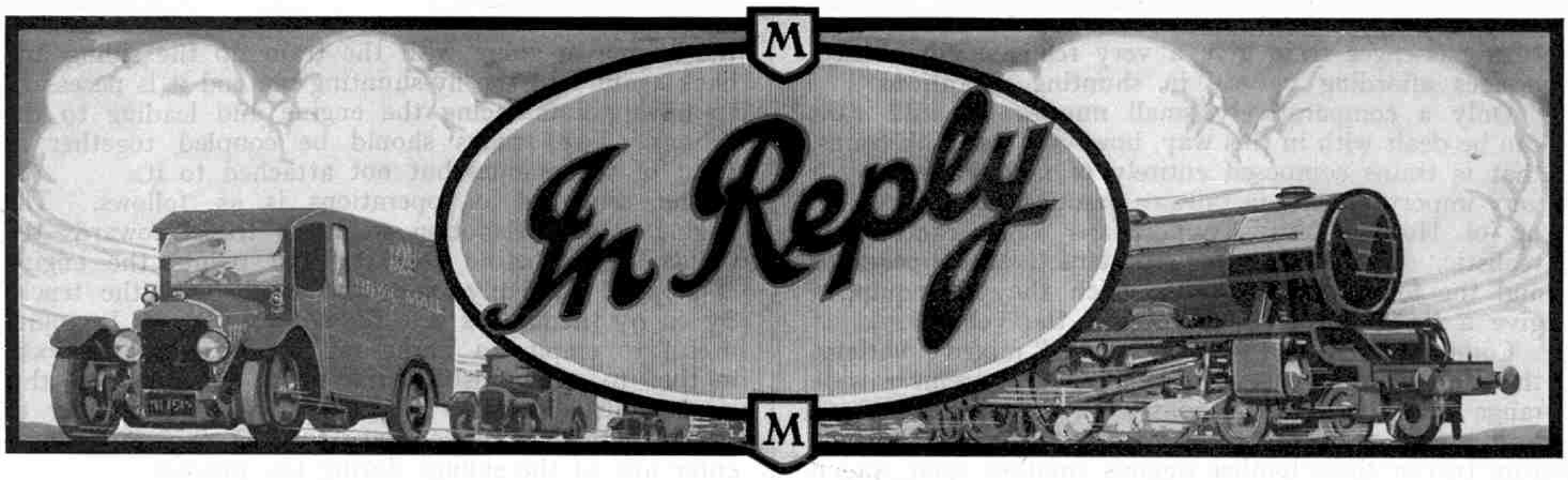
Fly-shunting should not be carried out too violently when near buffer stops or standing trucks, as a derailment may occur with disastrous results. This, however, is a point on which the operator's experience will be the best guide.

In previous issues we have dealt with the question of suitable loads for goods wagons. A great deal of additional interest is added to the making-up of trains if a good proportion of the wagons are loaded, and with a considerable variety of material. In the case of loads of loose material the wagons should not be too full in order to avoid any upsetting due to over-energy in shunting, which cannot always be avoided. One or two trucks covered with tarpaulins neatly fastened down also add considerably to the interest and provide real "atmosphere."

A great deal of fun may be obtained by imagining a model railway to be running through a country of a particular type, mineral, agricultural, etc., and making up goods trains accordingly.

Simple scenery to represent an industrial area can very easily be built up out of cardboard on the lines indicated in the "*How to Get more Fun*" article in the February "*M.M.*" Representations of collieries, even if quite roughly produced, make the railway look busy, and form an effective background for trains of open coal wagons clattering along, with other wagons, some loaded and some unloaded, standing in sidings.

Suitable scenery for an agricultural district is quite as easy to prepare. A thickly wooded background might be used to indicate a timber country, to fit in with trains of Lumber Wagons and Timber Trucks. A small pile of logs similar to those that are provided with the Lumber Wagon look very realistic when placed alongside the line. A miniature quarry provides an interesting scenic effect, and affords an opportunity for the extensive use of Hopper Wagons, Rotary Wagons and Side Tipping Wagons, all of which are utilised by quarrymen in transporting gravel, clay and stone. Many other equally interesting schemes could be worked out.



Suggested Hornby Train Improvements

MAIL VANS.—We still receive numerous requests for the introduction of mail vans and pick-up apparatus. As we have already announced in these pages, this idea is receiving our careful consideration, and when a decision has been arrived at an announcement will be made. (*Reply to R. Bayes, Northants; D. Hill, Wolverhampton; J. Lowndes, Lithgow, N.S.W.; and others*).

SHUNTING SIGNALS.—We do not think there is any great demand for a signal of this type. It is quite easy to make one by cutting out a small cardboard ring and placing it on the arm of a standard Hornby 'Home' signal. (*Reply to B. Maunsell, Sevenoaks*).

ELECTRICALLY-OPERATED POINTS.—We agree that electrically-operated points have a special interest of their own, but we are afraid we cannot introduce them to the Hornby system at present. The greatest drawback to such points is their very high cost of production. (*Reply to E. J. Smedley-Aston, Stratford-on-Avon*)

DETACHABLE LAMPS.—You will be interested to know that our forthcoming revised locomotives will be fitted with detachable head lamps. (*Reply to P. A. Farrant, Sutton, Surrey; R. L. Blakeney, Twickenham; M. P. Reason, Leeds*).

COLLIERY WAGONS.—Your suggestion for wagons lettered with the names of well-known collieries is interesting. Unfortunately, there is a limit to the number of individual wagons of this type. If we were to adopt every suggestion for special lettering we should have so many different wagons that our dealers would not be able to find room for them! (*Reply to G. Jarrett, Clevedon, Somerset*).

BANANA VAN.—You are no doubt right in thinking that a banana van would be a popular addition, but we have so many new schemes on hand that we cannot undertake the introduction of such a van at present. (*Reply to J. L. Gillard, Clifton; P. A. C. Evans, Stockport*).

MINIATURE BARRELS.—Barrels and other similar articles made to scale are certainly very useful for model loads. We do not propose to introduce such articles at present, but we may do so later. (*Reply to W. S. Maley, Whitstable*).

OIL BOXES ON ROLLING STOCK.—Oil boxes have been fitted to our latest type Pullman cars. Possibly they will be fitted to other rolling stock as opportunity arises, but nothing definite can be said at the moment. (*Reply to F. R. Monk, Warrington*).

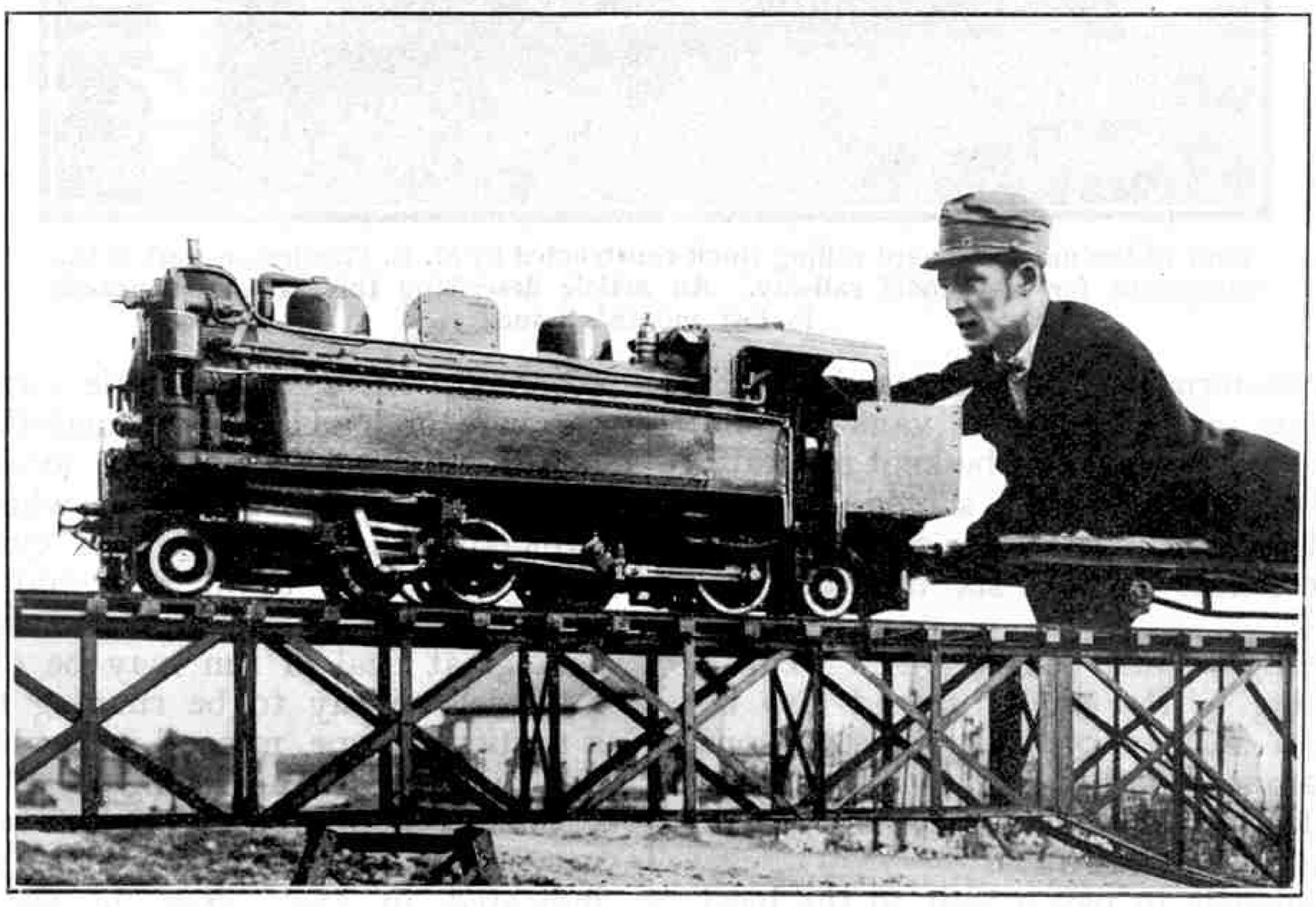
SLIP COACH APPARATUS.—As we have previously stated, the introduction of a slip coach has had careful consideration but no definite decision has been made so far. The idea will not be shelved, however, for there appears to be a demand for such a coach. (*Reply to L. Thompson, Tynemouth*).

MODEL GASWORKS.—Your suggestion is interesting, but we hardly consider gasworks to be an essential feature of a model railway. (*Reply to D. Brown, Tunbridge Wells*).

SENTINEL-CAMMEL STEAM COACH.—We do not doubt that the Sentinel-Cammel steam coach would make an extremely interesting and attractive model. If this type of coach comes into more general use we may be able to include it in the Hornby System. (*Reply to J. S. Maples, Lowestoft*).

DOUBLE BOGIE TENDER.—Your interest in a double bogie tender is quite natural, but we think you will understand that such a tender would probably not appeal in this country where the type is unfamiliar. (*Reply to C. Warner, Auckland, N.Z.*).

HORSE BOXES.—A horse box probably will be one of the first additions to be made to Hornby rolling stock. (*Reply to D. Edwards, Ludgers Hall, Wiltshire, and H. Gordon, Nairn*).



This small locomotive is capable of hauling a load of eight passengers at a speed of over 15 miles an hour. It was constructed by a Viennese, M. Frantz Rubak, who is shown here starting for a ride on the truck

DYNAMOMETER CAR.—A well-designed car of this type would be very costly to produce, and we do not think it would appeal to more than a very small number of model railway enthusiasts. (*Reply to W. Owen, Warwick*).

HORNBY CONTROL LEVEL CROSSING.—We are considering the introduction of Level Crossings and other fixed accessories fitted for operation by the Hornby Control System. We agree that Level Crossings so operated would form extremely interesting additions to Hornby railways, but many difficulties must be overcome before your suggestion can become a practical proposition. We may mention here that several Hornby enthusiasts have succeeded in setting up a very realistic control cabin and wheel from which to work the existing Hornby Level Crossing. (*Reply to P. Conway, Wem, Shrop.*).

SEATS IN PULLMAN CARS.—The addition of seats in Pullman cars would certainly make these cars more complete, but they would be so inconspicuous that they would not justify the necessary increase in cost. (*Reply to A. Taylor, Newcastle*).

LARGE BUFFER HEADS.—We have experimented with buffers of the type you suggest, but we find that they do not prevent interlocking on curves. They therefore serve no useful purpose, and we do not propose to introduce them. (*Reply to A. W. Griffiths, Burton-on-Trent*).

MINIATURE OFFICIALS AND PASSENGERS.—There can be no doubt that judicious placing of miniature officials and passengers makes a wonderful difference to a model station platform by introducing a suggestion of life. We have given very careful consideration to the possibility of introducing such 'small people,' and it is quite possible that we shall be able to make an announcement before long. (*Reply to N. Johnson, Canterbury; J. T. Scruton, Hull*).

LONGER TUNNELS.—Tunnels for model railways are always rather a problem. Our present tunnel is of such a length that it can be placed anywhere on almost any layout. A longer tunnel, on the other hand, would not fit in so easily. In addition, it would be much more costly and there would be little gain in appearance. (*Reply to M. Wright, Bexhill-on-Sea*).

EIGHT-WHEEL PASSENGER COACH.—There appears to be a considerable demand for the introduction of a passenger coach of this type, and we shall give the matter very careful consideration. (*Reply to R. H. Courage, Banbury; C. Harris, Bognor; E. H. Edwards, Gravesend; J. Smallwood, Leeds; E. Kennedy, Liverpool; W. E. Bullon, London, N.W.10 and others*).

ELECTRIC DOUBLE TRACK.—We agree that electric double track would add very considerably to the scope of an electric layout. We cannot make any definite announcement at the moment, but the possibilities of such track are being carefully investigated. (*Reply to O. Faunch Whitstable*).

DOUBLE LOADING GAUGE.—The type of loading gauge now in use is very popular and appears to meet all requirements. For this reason we do not think it necessary to introduce any other type. (*Reply to P. H. Briggs, Wilmslow*).

COUNTRY STATION.—It is probable that there will be considerable developments in regard to Hornby Stations in the near future. (*Reply to B. O. Tozen, Plymouth*).

LAMPS FITTED TO SIGNALS.—The fitting of lamps to our present signals would involve very considerable reconstruction, and we cannot consider the change at present. (*Reply to K. Kay, Paisley*).

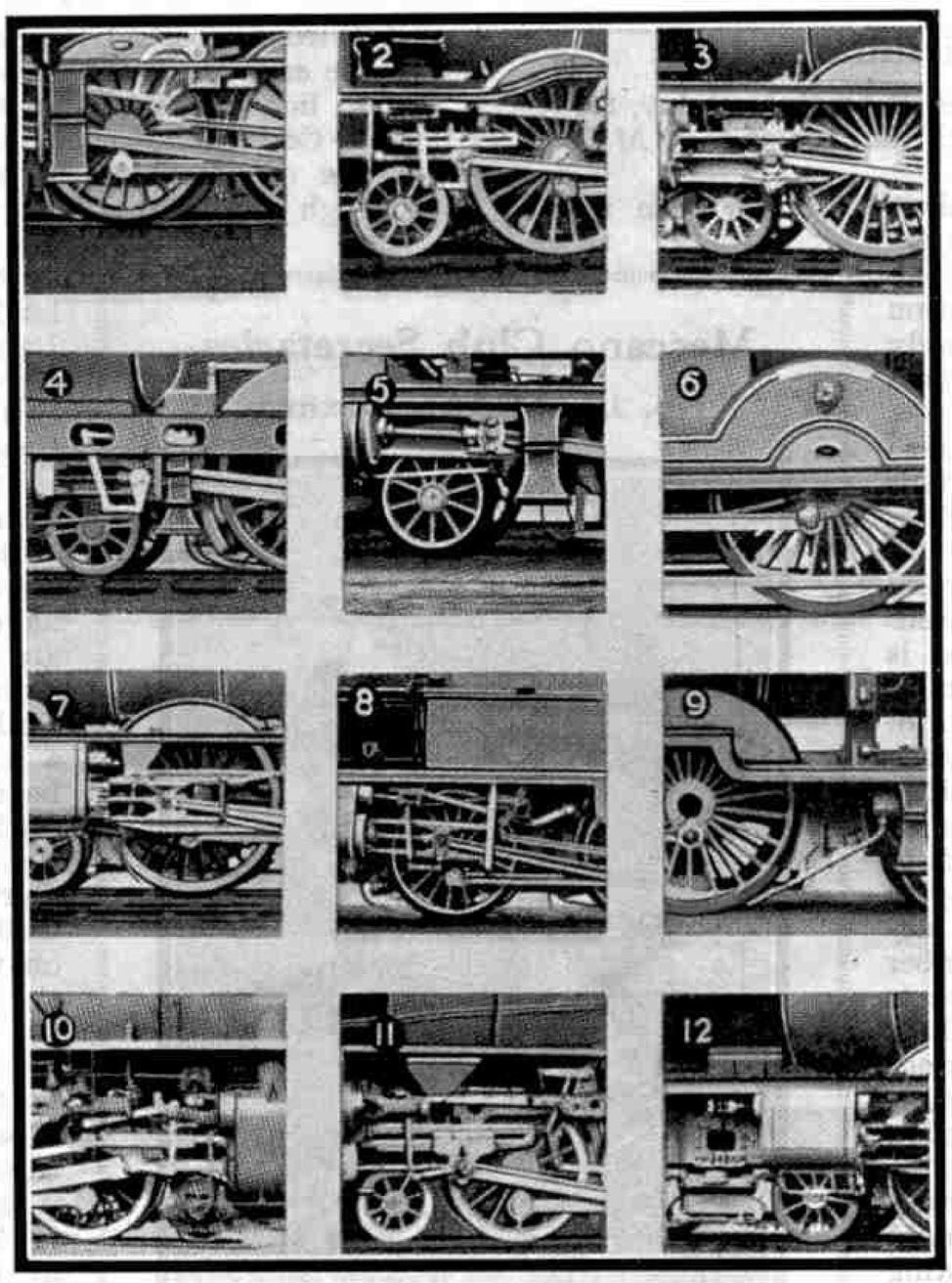
TABLES FOR HORNBY LAYOUTS.—Your suggestion for the introduction of special tables for Hornby Train layouts is impracticable. The requirements of different people vary so greatly that it would be almost impossible to design a standard pattern that would meet with general approval. Many Hornby enthusiasts have their railways running on a low shelf built around the walls of a spare room or on a long trestle table in the middle of the room. There is little difficulty in carrying out the necessary work. (*Reply to D. S. Perley, Earls Court, S.W.5*)

H.R.C. COMPETITION PAGE

A Unique Locomotive Problem

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

This month we give members of the Hornby Railway Company an excellent opportunity of putting their knowledge of locomotive types to a practical test. All that is needed when entering this competition is a sheet of paper and a pencil and a good knowledge of railway engines. Each of the 12 small illustrations appearing in the centre of this page shows a section of a well-known locomotive, a photograph of which has appeared previously in the "*M.M.*" Now for the terms of the competition. The problem is to identify the various locomotives concerned. Competitors should first of all examine carefully each of the 12 illustrations, and after deciding which locomotive each one represents they should write on a postcard as many particulars as possible—class, wheel arrangement, name of owning railway company, etc. It is probable that many competitors will be unable to identify all the locomotives, but that should not deter them from sending in their entries complete as far as possible. The solutions should be numbered to correspond with the illustrations. The entries will be divided into two sections as usual, Home and Overseas.



Prizes of Hornby goods, or Meccano if preferred, to the value of £1-1s., 15/–, 10/6, and 5/– respectively will be awarded to the four competitors in each section who submit the most correct and detailed lists. In addition, a number of consolation prizes will be awarded in order of merit to the best of the remaining entries. In the event of a tie, the prize will be awarded to the competitor whose solution contains the fullest details. If none of the entrants succeed in giving an all-correct solution the prize will be awarded to the entry containing the least number of errors. General style and neatness will be taken into consideration when judging.

Envelopes or postcards should be plainly marked " Loco Problem " in the top left-hand corner, and should be posted to reach Headquarters at Binns Road, Old Swan, Liverpool, on or before 29th June. The closing date for the Overseas Section is 31st August.

So many entries in our recent Hornby Railway Company Competitions have had to be disqualified for various reasons that it is necessary to emphasize one or two of the essential conditions. In the first place, quite a number of competitors submitted entries of really excellent quality, but without the slightest trace of their name and address ! In such cases, of course, we can only consign the entry to the waste paper basket. Every postcard or sheet of paper that is sent in as an entry to a competition should bear the competitor's name and full address clearly written in block lettering.

A second essential point is that each competitor must give, along with his name and address, his Hornby Railway Company registration number. This is a vital condition, and we hope that competitors will pay particular attention to this point, for although it has been repeatedly stated that this number must be given it is quite often omitted, with the result that the entry has to be disqualified.

Second H.R.C. Photographic Contest

Our first H.R.C. Photographic Contest produced a large and interesting collection of entries, some of which we hope to reproduce as opportunity arises. Unfortunately, however, many of the photographs submitted, while obviously representing interesting layouts, were utterly unsuitable for reproduction.

One of the commonest faults was lack of sharpness, this defect being of course absolutely fatal. It seemed to us that many of these photographs had been taken with small box cameras, such, for instance, as a Kodak " Brownie," without the use of a supplementary lens. With any fixed focus camera of this type a supplementary lens is absolutely necessary for close-up photographs. A special lens is made for each camera, and is sold at a low price.

Among other defects the most prominent was that of confusion resulting from the inclusion of details in the background that had no connection with the layout. Once more we recommend H.R.C. members to use a plain background such as a large sheet of brown paper.

In the hope of obtaining a better series of photographs we have decided to hold this month another competition for "*The Most Interesting Model Railway Photograph.*" Prizes are offered of Hornby Railway material (or Meccano if preferred) to the value of 15/–, 10/6, 5/– and 2/6, respectively for the four most interesting photographs in order of merit in each of the two sections, Home and Overseas. Envelopes should bear the words " H.R.C. Photos " in the top left-hand corner.

Closing dates—Home Section, 29th June. Overseas, 31st August.

H.R.C. COMPETITION RESULTS—HOME

February Photographic Competition.—First : H. R. N. Iniff (5314), Haws Hill, Carnforth, Lancs. Second : J. Lawrence (6439), Walton Road, East Molesey, Surrey. Third : Francis Maurice Clarke (2856), Newland Avenue, Birkby, Huddersfield. Fourth : D. Williams (3886), Summerfield, Marlborough, Wilts.

February " Layout " Competition. First : R. D. Tonkin (2075), 744, Fulham Road, London, S.W.6. Second : Peter Thorp (790), Nork Way, Banstead, Surrey. Third : L. Dash (1384), 6, Clavering Avenue, Barnes, S.W.13. Fourth : W. Snowdon (3774), " Hillcrest," Heddon-on-the-Wall, Newcastle-on-Tyne.

OBJECTS of the GUILD

To make every boy's life brighter and happier.

To foster clean-mindedness, truthfulness, ambition and initiative in boys.

To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

The Meccano Guild

With the Secretary

Guild's Tenth Birthday

This year the Meccano Guild celebrates its tenth birthday, for its inauguration was announced in the tenth number of the "*M.M.*," which appeared during 1919.

The growth of the Guild during this period has been really extraordinary. No fears were ever entertained at Headquarters with regard to its success, for at the time of its inception the number of Meccano boys had already reached a million, and the Guild was formed in response to repeated requests from boys all over the world that we should establish a central organization to help them to make the most of their hobby. But its development has exceeded all expectations, and year by year its growth has proved beyond all possible doubt that it filled a real need. To-day the little triangular badge that is the emblem of the Guild may be seen in practically every country in the world.

As soon as the Guild was firmly established, its members in various localities began to form themselves into groups to exchange views on model-building, and to enter into friendly rivalry in engineering in miniature. From these groups have developed the Meccano Clubs, that now number nearly 300, and are to be found in all parts of the world. Month by month new clubs spring into existence, and the older ones grow steadily in membership and influence. In the towns and villages where they exist, Meccano Clubs are recognised as valuable institutions, and it has become generally realised that these clubs have a splendid influence for good, in addition to assisting their members to obtain the utmost possible fun from Meccano—the greatest hobby in the world.

During the past year or two it has been a source of particular encouragement to notice how the Meccano Guild is growing in parts of the world where at first it seemed to make comparatively little appeal. In the United States, for instance, it made little progress for some years. It has won its way by sheer merit, however, and to-day it is growing steadily in all directions. Many of the greatest engineering undertakings in the world are to be found in the United States, and American engineers of all ages have come to realise the unique possibilities of Meccano in the reproduction of engineering structures in miniature, yet on lines that are absolutely sound from a mechanical point of view.

World Wide Development

Another great stride forward is being made in Spain and South America. During the past few years the Guild membership in Spanish-speaking countries has grown steadily, and special literature is now printed in the Spanish language, in which the aims and objects of the Guild are fully explained.

Along with these more recent developments, steady growth has continued throughout the whole of the British Empire, in almost all European countries, and as far away as China and Japan. In the early days of the Guild the barrier of distance was a drawback, but this has been swept away by the introduction of the Guild Correspondence Club, membership of which is open without charge of any kind to every member of the Guild. To-day, through the medium of this club, thousands of Meccano boys are writing to friends in different parts of their own country or in far-off foreign lands, and building up firm friendships. Large numbers of these correspondences have been carried on with the greatest enthusiasm for years, and in many cases they have led to the interchange of visits to the writers' respective homes during holiday periods.

In spite of all this wonderful growth, there are still great numbers of Meccano boys who have not yet joined the Guild, and therefore are missing a great deal of interest and enjoyment in their hobby. I should like the Guild to celebrate its tenth anniversary by a huge increase in numbers, and it would be splendid if every member would make up his mind to give a birthday present to the Guild in the shape of a new member recruited by himself. I hope that every Guild member will make up his mind to act on this suggestion, and thus help to raise the membership to 200,000.

Summer Reports

It is important that secretaries should forward reports as regularly during the summer months, as in winter, especially if a club is pursuing a programme that is keeping the interest of its members at a high level. This year many clubs are making the experiment of keeping together throughout the summer for the first time, and they will be encouraged to persevere by reading accounts of successful summer sessions of other clubs from which they may gather valuable hints for their own programmes.

I am always pleased to read of the outdoor activities of clubs, and particularly desirous that members should indulge in health-giving sport and recreation in the open air as much as possible. There is no better place for practising the spirit of the Guild than on the cricket field, or in the pursuit of other games, for these enable members continually to make new friends.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters, whose names and addresses are given below:—

BIRMINGHAM—G. Wallis, 69, Fountain Road, Edgbaston.
NEATH—G. V. Rees, Bird-in-Hand Hotel, Neath, Glam.
PORTSMOUTH—Mr. J. S. Kent, 57, Kirby Road, North End.
SWANSEA—W. M. Thomas, Greenhill P.O., Swansea, Glam.
SWALWELL-ON-TYNE—J. Lockwood, 19, Richmond Avenue.
WILMSLOW—R. Mason, The Downs School, Colwall, Nr. Malvern.

Meccano Club Secretaries

No. 17. Miss G. Flexman



Chelmsford Meccano Club is one of the few clubs that have lady secretaries. Miss Flexman's enthusiasm and hard work have been of the greatest value to the club, which is showing splendid progress. Members are particularly enterprising in summer activities and hope to repeat last year's success, when they won a prize for a decorated motor car in the Chelmsford Annual Carnival



CLUB NOTES



Hull Grammar School M.C.—A Model-building Competition has been held in which entry was open to non-members attending the School. The models constructed were on view at an Exhibition, along with a two-cylinder Horizontal Steam Engine loaned from Headquarters. To one meeting the Leader brought a model Donkey Engine made by himself. This worked exceedingly well and drove several Meccano models. Club roll: 28. *Secretary*: K. King, 37, Louis Street, Springbank, Hull.

Harehills (Leeds) M.C.—Air Rifle Shooting Competitions have been instituted and members are becoming skilled marksmen. In a special Model-building Competition the President, Mr. W. J. S. Carpenter, offered prizes of Meccano and Hornby Train goods for the three best entries. These were judged at the Exhibition, which was a huge success and aroused great interest in the district, a splendid report appearing in the "*Leeds Mercury*." A very enjoyable visit was paid to the printing works of Stembridge & Co. Ltd., where the members saw the "*M.M.*" passing through the press. Summer activities include rambles and cricket. Club roll: 24. *Secretary*: R. K. Fourness, 12, Berkeley Street, Leeds.

Tynecastle School M.C.—Has now secured affiliation and is making good progress. Members have been divided into three sections, "Nuts," "Bolts," and "Clips," and points are being awarded to each for model-building and attendance. The Leader gave an excellent talk on "*Photography*." Model-building has so far been the chief occupation, parts being loaned to members from the club's store. Club roll: 16. *Secretary*: Wm. Urquhart, 4, West Mill Road, Colinton, Edinburgh.

Middlesbrough M.C.—The fourth Annual Exhibition was a great success. The large display of models included a Dredger and a Tank Locomotive kindly loaned by Mr. Scupham, and three large working models from Headquarters. A Hornby Electric Train layout occupied an entire room, which was crowded throughout the Exhibition. Gramophone selections were given at intervals, and an Inquiry Bureau was an innovation that resulted in the enrolment of several new members. A Mock Election for the position of secretary of the club ended in a tie. Each of the three candidates had a different policy for the improvement of the club and exciting meetings were held. Club roll: 76. *Secretary*: A. Bradley, 95, Deepdale Avenue, Marton Grove, Middlesbrough.

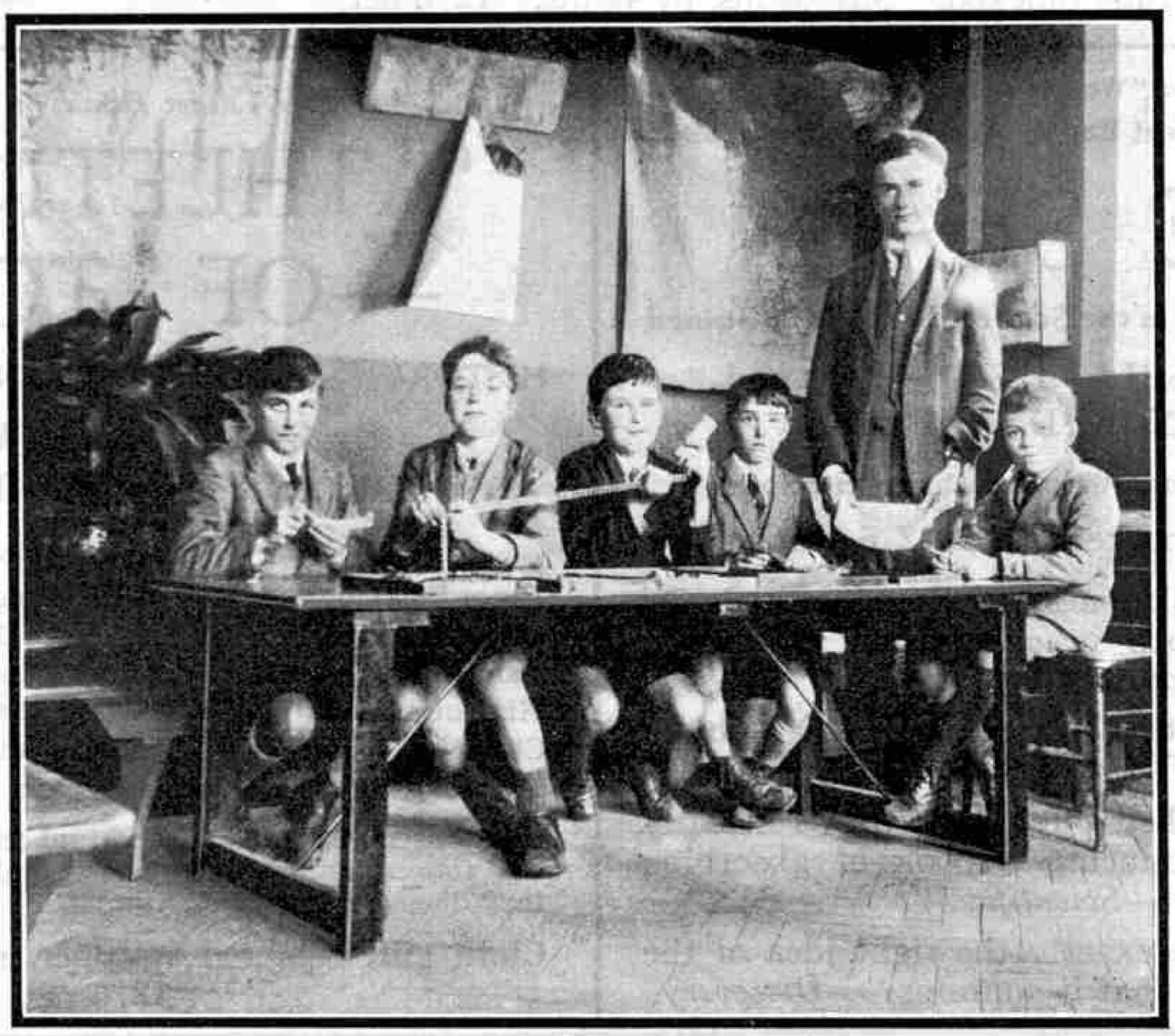
Sittingbourne & Milton M.C.—A Lantern Lecture on "*London's Underground Railways*" was greatly enjoyed. Model-building Competitions and Hornby Train Nights have been continued, and members have taken up Fretwork as an additional hobby. A new club room at the Borden Grammar School has been secured. Club roll: 39. *Secretary:* H. Rivett, 44, Ridham Avenue, Kemsley.

Annan M.C.—The display at the Annual Exhibition was the best ever seen at these functions and a record number of visitors were greatly impressed by it. A Hot Air Engine that drove several working Meccano models attracted special attention, and a noteworthy feature was a large collection of simple models of Ladders, Wheelbarrows, Telpher Spans, etc., constructed by junior members. The Hornby Train Layout was large enough to accommodate twelve locomotives. The programme for the Summer includes Cricket and a Holiday Camp. Club roll: 33. *Secretary:* W. F. Duff, 10, Hecklegirth, Annan.

Southport M.C.—A Hornby Train section has been formed, operations being carried out in accordance with timetables printed on the machine used to produce the club Magazine. Interesting Lantern Lectures on "*London's Underground Railways*" and "*London's History and Romance*" have been given. The club possesses a large stock of Meccano parts, and models are being constructed for the Annual Exhibition. Club roll: 27. *Secretary*: W. E. Williamson, 10, Delamere Road, Ainsdale, Southport.

South Park School (Ilford) M.C.—Two very interesting Lantern Lectures have been given, one on "*Aviation*" and the other on "*North Wales*." Model-building Nights are always well attended, and the models constructed are of a high standard. Club roll: 45. *Secretary*: D. Bradford, 14, Talbot Gardens, Goodmayes, Essex.

Bedlington Secondary School M.C.—The syllabus has included an interesting talk by Commander Kemp on "*Peace and Industry*," and a debate on the advantages of "*Road v. Rail Transport*," in which the voting went in favour of rail transport. An interesting visit was paid to the coal mine at New Moor, Ashington, and the local Fire Station was inspected. Club roll: 17. *Secretary*: J. W. Dobson, 1, Portland Terrace, Ashington, Northumberland.



Our photograph shows some of the members of the Merelands Meccano Club at work under the direction of the leader, Mr. A. V. Schlienger. The club was affiliated in May 1927. It has a very varied syllabus, and next to model-building photography is the favourite feature

St. Giles (Grimsby) M.C.—Models entered in recent Competitions have included a Windmill, Lorries, Aeroplanes, and several Ships. Hornby Train Nights are specially popular, members bringing their own train sets and constructing a large track on which operations are conducted in a realistic manner. Games conclude most of the meetings. Club roll 7. *Secretary*: W. B. Vickers, "Glenroy," Scarthoe, Grimsby.

Fulstow Junior M.C.—In a recent Model-building Competition a model chosen by the Leader from the Manuals was constructed by every member present, the prize being awarded to the one who constructed it satisfactorily in the shortest time. A most interesting Lantern Lecture was loaned by the De Havilland Aircraft Co., to which visitors were invited. Admirable short reports of meetings of the club appear in the local press. Club roll: 10. *Secretary*: L. W. Doe, The Stores, Fulstow, North Thoresby, Lincs.

Exmouth Y.M.C.A. M.C.—The Exhibition was highly successful and remarkable for the many excellent models on view. These included a Weighing Machine, Roundabout, Luffing-Crane, and Warehouse, a Meccano Motor Chassis, kindly lent by Mr. MacLaren, a local dealer, and a splendid model of Capt. Campbell's "*Bluebird*" lent by Mr. J. Shapley. A Lecture on "*Architecture*" by the Leader, and one on "*Railways*" by the Station Master of Exmouth, were very interesting. Cricket is to be the chief Summer recreation. Club roll: 26. *Secretary:* J. Bulled, 2, Waverley Road, Exmouth.

Winchmore Hill Collegiate School M.C.—In recent Model-building Competitions members were required to construct Motor Cars and Cranes, very ingenious models being entered in each case. An interesting visit was paid to "*The Times*" Printing Office. A debate on the "*Channel Tunnel*" ended in a narrow victory for its opponents. The secretary gave an interesting talk on Sir H. Segrave's record-breaking car "*Golden Arrow*," and "*Miss England*," his motor boat. Club roll: 37. *Secretary*: R. Truscott, 10, Old Park Road, Palmers Green, London, N.13.

Braintree High School M.C.—At a Hobbies Meeting each member gave a brief account of his favourite hobby and where possible showed specimens of his work. A Library has been started; the books are mostly on Engineering subjects but others on Stamp Collecting and Nature Study will be included. Cricket and excursions to factories and places of interest are being arranged. Club roll: 26. *Secretary*: P. Allen, St. Edmunds, Bocking, Braintree, Essex.

Chelmsford M.C.—A Joke Night was much enjoyed, each member reading what he thought was the best joke appearing in "*Fireside Fun*" during the last twelve months. Models built include Aeroplanes of different types, Elevator, Fordson Tractor with Trailer, Beaming Frame for Meccano Loom, and a Battleship. Hornby Train Nights are a special feature, the clubroom being suitable for a large layout. Club roll: 27. *Secretary*: Miss G. Flexman, Saracen's Head Hotel Tap, High Street, Chelmsford.

St. Paul's (Lozells) M.C.—A Debate on "*Oil v. Coal*" was keenly contested and the honours were declared even. An interesting lecture on "*The Railways of England*" was given by the secretary, and Mr. W. B. Chivers, Leader of King Edward's Grammar School M.C. gave an exceedingly interesting talk on "*Electric Light.*" A large Hornby Train Layout has been constructed for which the members made scenic effects and accessories. Club roll: 18. *Secretary*: E. Cunningham, 93, William Street, Lozells, Birmingham.

St. Albans M.C.—Celebrated its fourth birthday by a party held at the Leader's house. Interesting visits already arranged include one to the local Waterworks. A cart decorated by the club took part in the local hospital procession. Members are keen on Semaphore Signalling, which is to be taken up during the Summer. Mr. H. E. Wortley, a master at St. Albans School, gave an interesting Lecture on "*Aeroplanes*," at which members of the Harpenden M.C. were present. Club roll: 23. *Secretary*: H. M. Upward, Southmead, 19a, Worley Road, St. Albans.

Hessle M.C.—The Exhibition was quite successful, models loaned from Headquarters and a large Hornby Train Layout being very attractive to visitors. For several weeks members had diligently rehearsed working to a timetable in order to ensure success. Club roll: 12. *Secretary*: T. A. Fillingham, "Red Lea," Marlborough Avenue, Hessle.

Egypt

Students' (Cairo) M.C.—Interesting Model-building and Fretwork Evenings have been held, and a special feature is made of Indoor Games. Two Lectures have been given, one by the secretary on "*Heroes of Industry*" and one on "*Egyptian Automatic Telephones*" by one of the members. Club roll: 18. *Secretary*: M. Younis, 7, El Arbein Street, Saida Zenab, Cairo, Egypt.

South Africa

Villieria (Pretoria) M.C.—The Social Evening was a great success and a very enjoyable time was spent with Games of all kinds, Music and Recitations. Good progress is being made with the large Model Railway layout, and members are very enthusiastic over this scheme. Club roll: 16. *Secretary*: J. F Wood. 723, 5th Street, Villieria, Pretoria.

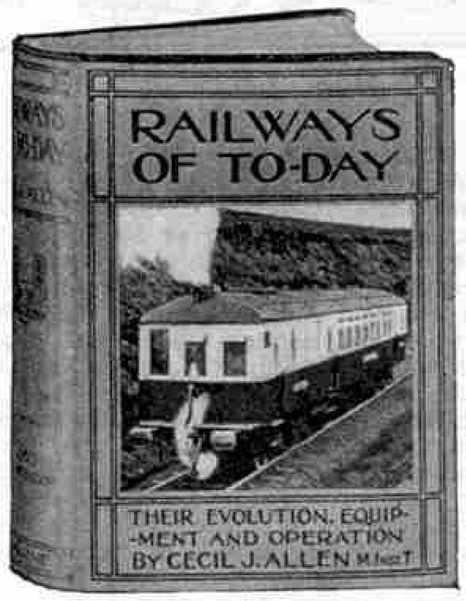
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Famous Trains—(*Continued from page 445*)

where, if we have taken a pilot, we make a brief stop for it to come off the train. Re-starting, a swift downhill run, with brake applications where necessary on the 1 in 50, of which, on this side, there are over five miles in continuous lengths, brings us to Shepton Mallet. For the 21¾ miles from Bath to this point 42 minutes may seem a generous allowance, but the gradients make it fully necessary. Still descending, we make the short run of 4¾ miles to Evercreech Junction in eight minutes, or probably less, reaching there at 3.26 p.m.

The next stretch of line is still double, and for the 10½ miles to Templecombe, sharply undulating, the timetable allows 15 minutes. Between Evercreech and Cole we cross the Westbury main line of the Great Western and then, diverging to the right at the Lower Junction at Templecombe, we run up into the main station there, alongside the West of England main line of the Southern. Getting away from Templecombe is a curious business, as we have to back on the Somerset and Dorset line again, at "No. 1" Junction, before we can proceed with our journey. Then we carry on to the southward, travelling over the single line from there to Blandford at a surprisingly high speed—often for miles continuously at well over 50 miles an hour—and taking the passing-places without any reduction of speed, as they are smoothly laid out and equipped for the automatic exchange of the single-line tokens. Stalbridge and Blandford are passed, and we are now in Dorset.

At Corfe Mullen Junction we branch rightward from the Wimborne line, climb over the ridge and drop to Broadstone Junction, with severe slacks at both junctions. Presently the big expanse of salt water in Poole Harbour comes into view, and at Holes Bay we run on to the main line of the Southern between Bournemouth and Weymouth, over which we travelled with "*The Thirties*" three months ago. Poole is reached at 4.35 p.m. We are on the final stage, and it is a steep one, part of the climb past Parkstone being at 1 in 60. The "*Pines Express*" is now at last within sight of the pines, and the tonic of their smell carries our locomotive over the summit at Branksome, whence we drop gently down the steep incline into Bournemouth West Station.

The time is 4.46 p.m.—at least it ought to be if we are punctual—and thus we have taken six minutes over seven hours on our long journey from Liverpool.

New Meccano Models—(*Contd. from page 477*)

The body of the animal (?) consists of 2½" Curved Strips, and 2½" Strips form its legs. Flat Brackets are secured to Angle Brackets for arms, whilst a Bush Wheel represents its head. Angle Brackets and Flat Brackets attached to the Bush Wheel form the nose and mouth. When completed the model should be mounted on a 5½" × 2½" Flanged Plate.



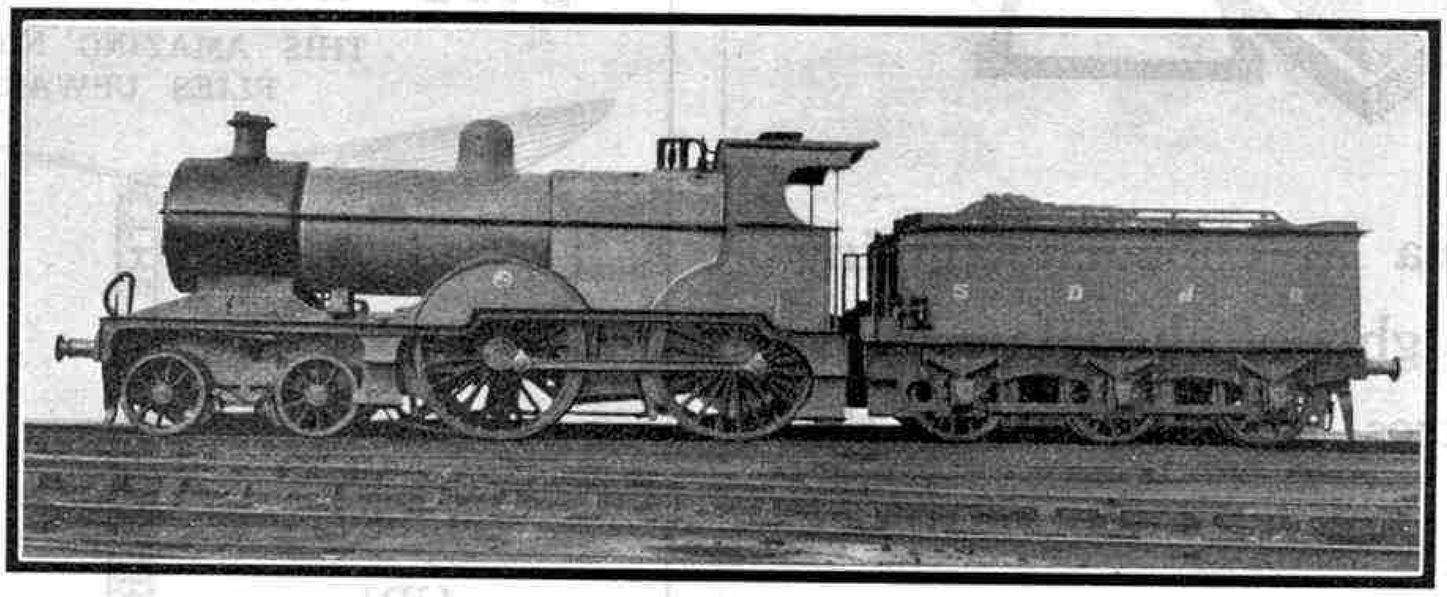
Photos courtesy] [*S. & D.J.R.*

Bath Station, L.M.S. The "*Pines Express*" is nearly ready for departure

As will be seen from the following list very few parts are required for the model. 5 of No. 5; 6 of No. 10; 6 of No. 12; 1 of No. 24; 23 of No. 37; 1 of No. 52; 4 of No. 90a.

Meccano General

Our final example of models this month is shown in Fig. 7. The illustration shows the horseman in the act of urging his followers to the attack, but by adjusting the various Strips composing the rider and his steed numerous other amusing attitudes can be obtained.



Locomotive No. 70, 4-4-0 type, Somerset and Dorset Joint Railway

For the horse's body three 3½" Strips are used, being bolted at each end to Double Brackets. Each of the legs consist of two 1½" Strips, while the neck is a 2" Strip. A Cranked Bent Strip is used to form the head with Flat Brackets for ears. The completed "animal" is secured to a 5½" × 2½" Flanged Plate by means of Angle Brackets.

The parts required for the horse and rider are :—3 of No. 3; 2 of No. 5; 4 of No. 6; 9 of No. 6a; 5 of No. 10; 3 of No. 11; 3 of No. 12; 1 of No. 17; 1 of No. 23; 2 of No. 35; 23 of No. 37; 1 of No. 44; 1 of No. 52; 1 of No. 111c.

Story of Rubber—(*Continued from page 455*)

of the machine is also drawn between the two lower rollers, with the result that the rubber sheet is pressed on to the fabric. The two materials pass forward and are carried round another wooden roller at the rear of the machine, the cloth effectually preventing the superimposed layers of rubber from sticking to one another.

In its present state the rubber sheet is very plastic, and if two such sheets were to be pressed together they would unite so completely as to become inseparable. This stickiness of the rubber disappears during vulcanisation, but if for any purpose the manufacturer desires to eliminate this adhesive quality before the material is vulcanised he does so by dusting a liberal quantity of French chalk over the surface of the rubber.

Vulcanisation is carried out either in a powerful hand-screw or hydraulic press, or in a long cylindrical boiler called a "vulcanising pan." In its simplest form the vulcanising press consists of two steam-heated, smooth-faced steel chests. The sheet to be vulcanised is placed between these chests, which are then brought together. Steam is admitted into them, and under the influence of the heat the rubber is vulcanised or "cured." Rubber will not combine with sulphur until heated above the melting point of the latter, and the temperature of the steam-heated chests is regulated carefully to achieve this purpose. Huge hydraulic presses combining several units, either superimposed or ranged side by side, are used in large rubber factories.

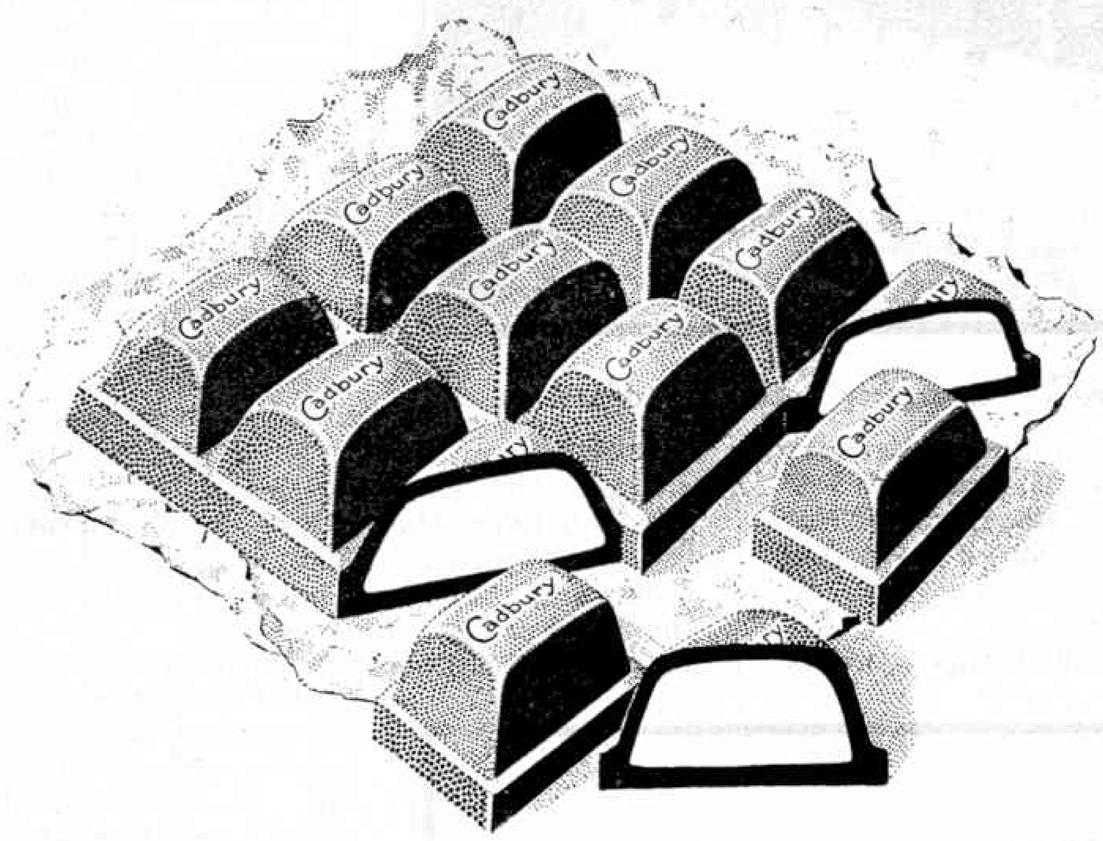
Vulcanising pans vary in lengths from 3 ft. to 60 ft., and in diameter from 3 ft. to 12 ft., and are steam heated. The articles to be vulcanised are placed on a light carriage that is run along a length of light rail extending into the pan. When they are safely inserted the length of rail is withdrawn, and the lid of the pan is closed and secured with heavy bolts. A popular type of vulcanising pan is steam-jacketed, the steam being retained under pressure until the pan has been loaded and sealed, when the steam is admitted.

The steady rise of temperature that takes place after the admission of steam is noted carefully on a thermometer which, in a protecting metal tube, extends outward from the inside of the pan. Other devices to assist the operator in regulating the heat are a pressure gauge and a safety valve. The length of time required for vulcanisation varies according to the composition of the rubber compound of which the articles have been made.

(*To be continued*)

Cadbury's

Chocolate Sandwiches



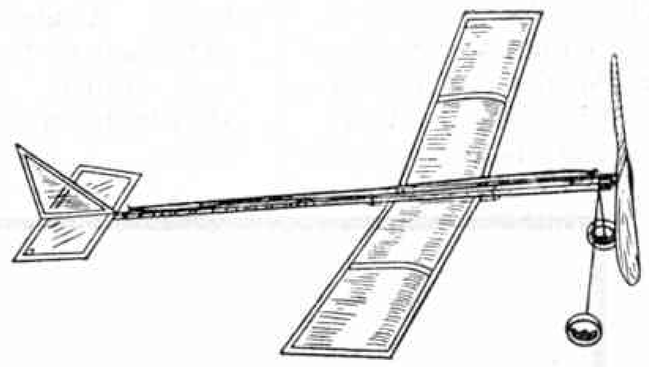
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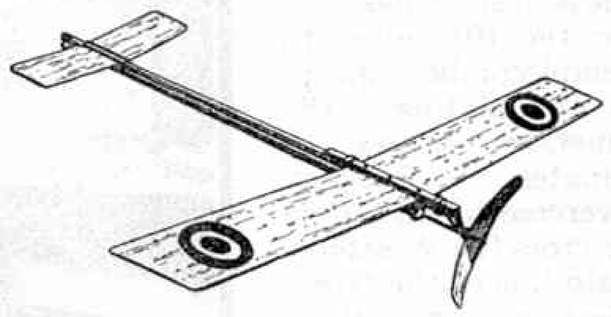
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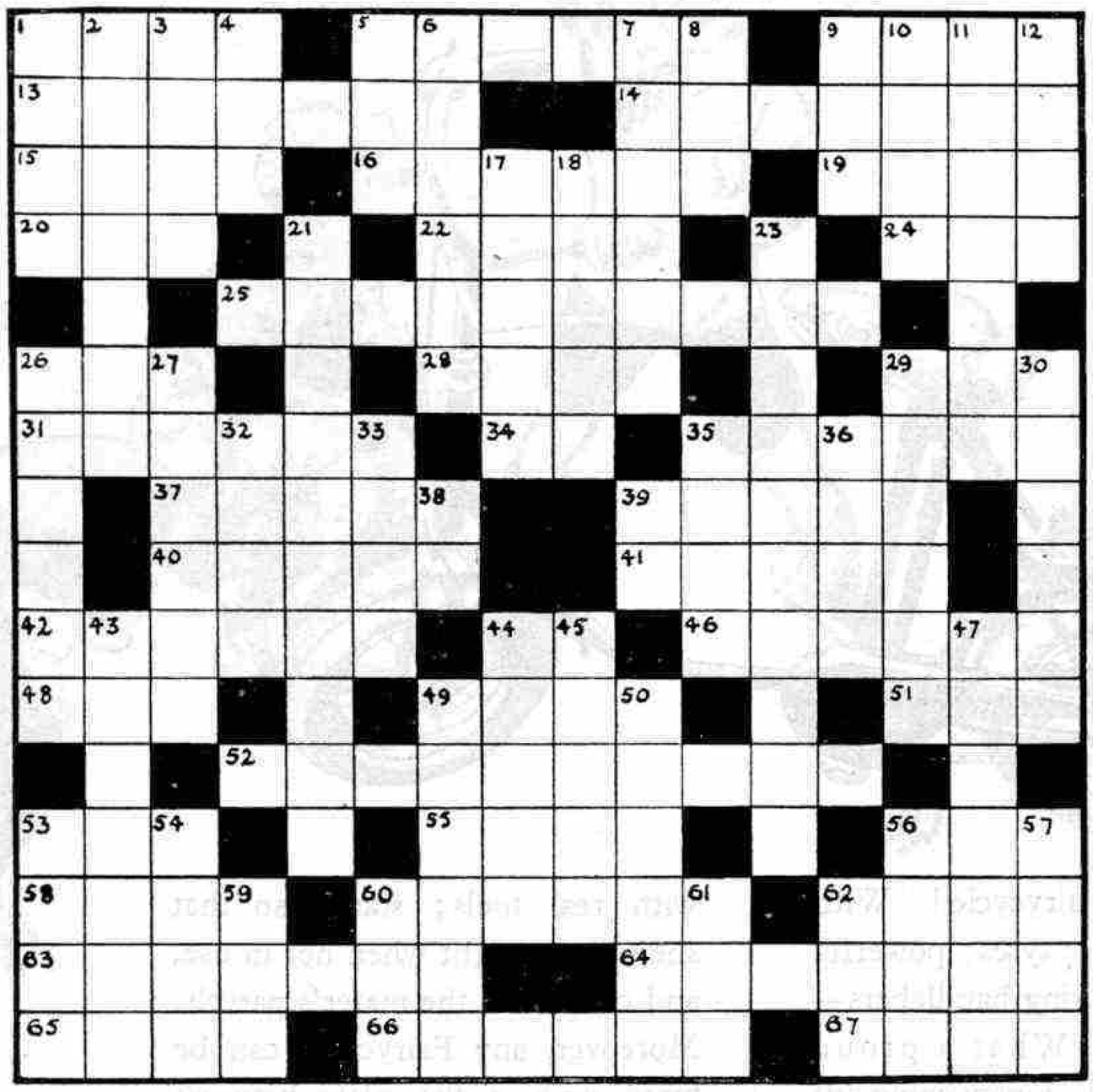
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Competition Page

Another Crossword Puzzle



CLUES DOWN

1. Tribal Stock
2. Irregular
3. Brilliant Actor
4. Metal
5. Mathematical Subject (Abbrev.)
6. Peaceful
7. Senseless
8. Famous Bridge
9. Cask
10. Word of Mouth
11. Bitten by horse
12. Wheelless Convevance
17. Coral Island
18. Cuts
21. Change
23. Wills
26. Comfort
27. Stoker
29. Baby's unhappiest task
30. Vindicate
32. Serpents
33. Fixes
35. Destroyed
36. Give Out
38. Point of Compass
39. Father (Relig. Contr.)
43. Honoured
44. Tree
45. Parted by force
47. Oriental
49. End
50. Meeting Places
53. Metal Thread
54. Book
56. Out o the Weather
57. Point of Compass
59. Negative Prefix
60. Vehicle
61. Note in Tonic Scale
62. Fellow of Linnaean Society (Init.)

CLUES ACROSS

1. Remainder
5. Receptacle for Refuse
9. Confusion
13. Literary Composition
14. Inborn
15. Fish Measure
16. Green
19. Wheel Hub
20. Human Organ
22. Famous Mountain
24. Male Human
25. Marked
26. Recline
28. German River
29. Beverage
31. Vast Quantities
34. Lives Shortened
35. Mounts
37. Animals
39. Rage
40. Grudge
41. Pardon
42. Plumes
44. King Charles (Abbrev.)
46. Sheep
48. Perpetuity (Contr.)
49. Linear Measure
51. Necessary to live
52. Firmness
53. Anti-prohibitionist (slang)
55. Fleet
56. Consumed
58. Common Metal
60. Embrace
62. Insect
63. Transfer
64. Wage earners
65. A Biblical Garden
66. Enjoy
67. Forwarded

Although the number of entries to the Stepword Contest showed that this novel form of word puzzle had proved very interesting to our readers, many of the competitors expressed the view that the more ordinary Crossword Puzzle was very much more fascinating, although requiring rather less ingenuity. There was a widespread request for another crossword puzzle at an early date, and we therefore give one this month.

The rules governing the solution of Crossword Puzzles require no explanation. We should like to make it clear, however, that it has been our endeavour, as far as possible, to avoid setting unfair traps, although, of course, the clues have had to be " wrapped in mystery " to a certain degree. Every word will be found to be quite straightforward, and can be found in Chambers' 20th Century Dictionary and other good dictionaries.

Prizes of Meccano Parts or Hornby Train Accessories, to be chosen by the winners, to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions in the order in which they are opened on the morning following the closing date. In addition there will be a number of consolation prizes.

Entries should be addressed to " June Crossword Puzzle, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should reach this office not later than 29th June. Overseas closing date, 30th September.

Competitors who do not wish to disfigure their magazines may draw the Crossword design on plain paper and submit their entries in that form.

41st Photographic Competition

As we write this note, in the early days of May, the temperature is strongly reminiscent of mid-winter, but our private weather expert assures us that summer is really coming, and that once again June will uphold its reputation of being the most beautiful month in the year. Certainly, in normal circumstances, the English landscape is then at its best and freshest, and for this reason we are selecting as the subject of our photographic competition this month " A JUNE LANDSCAPE." We make no restrictions of any kind as to what is to be included in the landscape, and all that is necessary is for the competitor to take a photograph of some interesting outdoor view.

Overseas boys, of course, will not be able to conform strictly to the limitations imposed by the title, and in this section competitors must read the title as a " landscape taken at any time of the year."

Entrants will be divided into the usual two sections, A for those aged 16 and over, B for those under 16, and cash prizes of 10/6 and 5/– are offered for the two best photographs in order of merit in each section. In addition, there will be a number of consolation prizes.

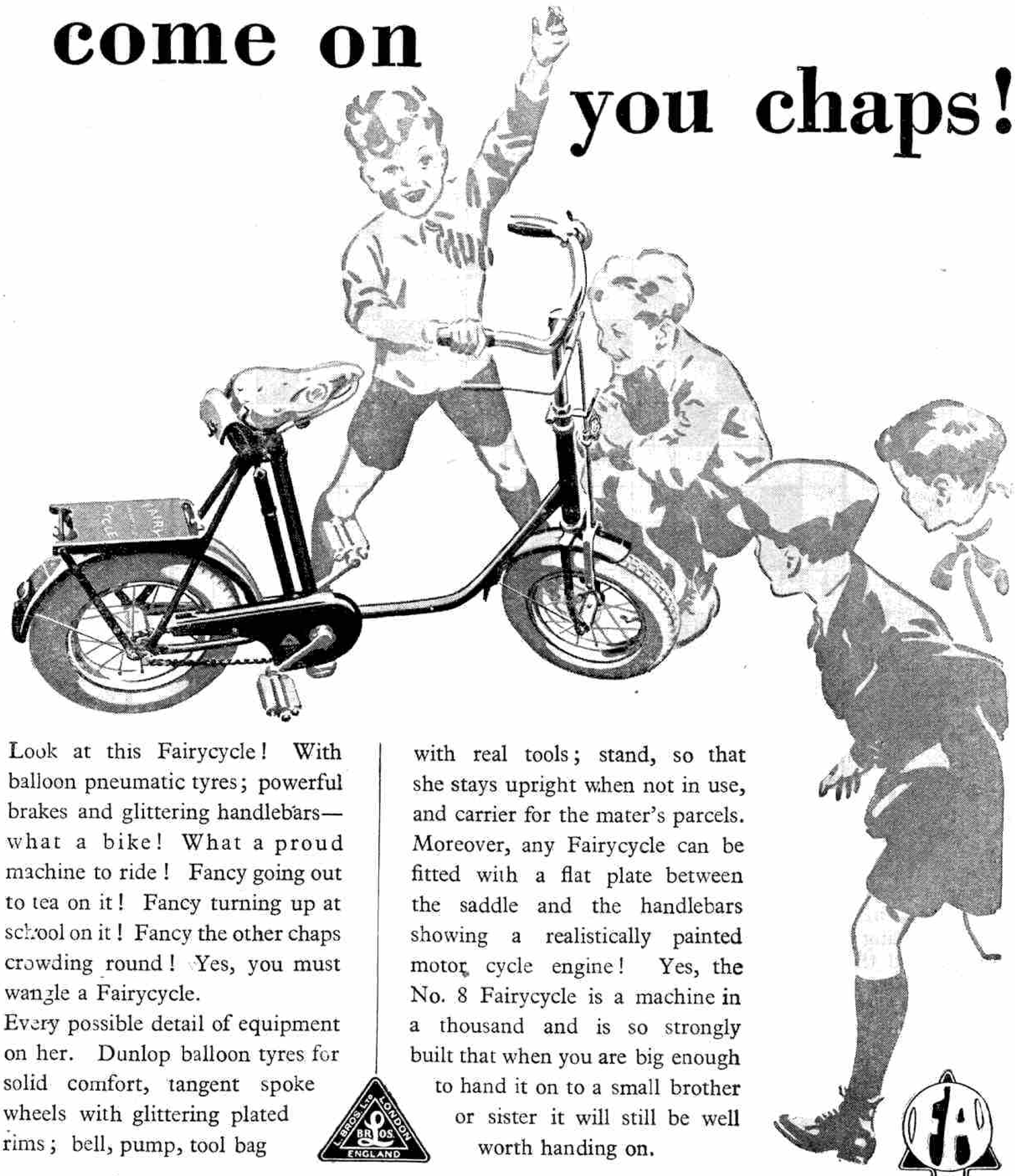
Entries should be addressed to " 41st Photographic Competition, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should be sent to reach this office not later than 29th June. Overseas closing date, 30th September.

COMPETITION RESULTS—HOME

Stepwords.—1. G. S. MARSH (Blackpool); 2. H. C. CHARLESWORTH (Lowestoft); 3. D. V. LEAROYD (Leeds); 4. J. M. WARREN (Gillingham). Consolation Prizes: J. R. SPOONER (Manchester); P. Simons (Burghclere); C. N. LEATHER (Rock Ferry); K. KING (Hull).

39th Photographic Contest.—First Prizes: Section A, H. JONES (Bicester, Oxon.); Section B, G. S. PARKER (Southampton). Second Prizes: Section A, O. A. KIMMINGS (East Acton, W.3); Section B, A. B. CHATFIELD (Crewe). Consolation Prizes: P. M. GOUGH (Coventry); R. D. CLARK (Highbury, N.5).

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Model C.—Raised pattern plated handlebars, has chain guard, stand, carrier, reflector and bell. Cycle pattern rim brake, 12" tangent spoke wheels, adjustable ball bearing hubs, 1" imitation pneumatic tyres - 49/6

Model Cx.—As model C but larger size with 14" wheels - 52/6

Model Px.—As model Cx but with 14" x $1\frac{3}{8}$" Dunlop "Kempshall" pneumatic tyres - 55/-

Model D.—Cycle type brakes, raised pattern plated handlebars, 2-coil spring saddle, etc. $\frac{1}{2}$" by $\frac{1}{8}$". Roller chain, adjustable ball bearings throughout, 12" tangent spoke wheels with 1" imitation pneumatic tyres, complete with chain-guard, stand and carrier, reflector and bell - 59/6

Model 6.—Strongly built for children up to 9 or 10 years old. 16" tangent spoke wheels fitted 1" imitation pneumatic tyres, adjustable ball bearings throughout, cycle pattern rim brake, Imitation pneumatic tyres, 3-coil spring saddle, tool bag, bell, etc. - - - - 70/-

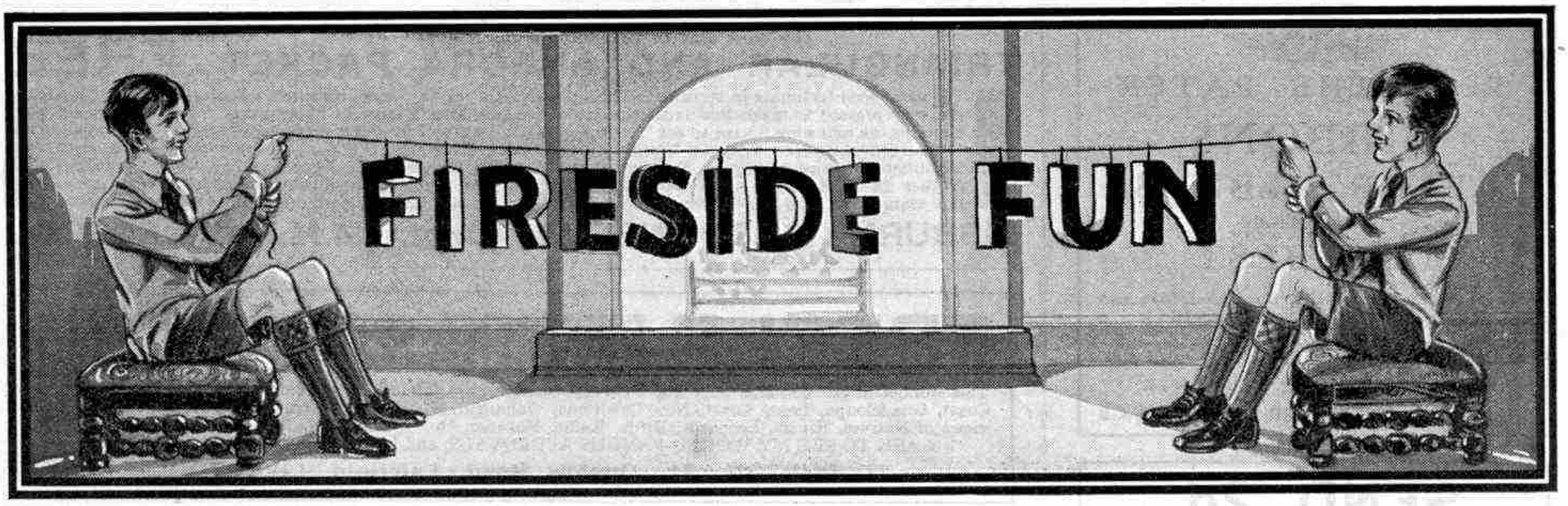
Model 8.—The "Rolls-Royce" of Fairycycles, raised pattern plated handlebars, $2\frac{1}{4}$" buttress tread Dunlop balloon tyres. Plated ball-bearing pedals, tool bag, carrier, stand, bell, reflector and pump, etc. - - 87/6

All these models with the exception of models A and AX are finished in black or blue, with gold lines. Fairycycles can be obtained at all good toy shops, or write for illustrated leaflet.

FAIRYCYCLE ASSOCIATION

Membership free to owners of genuine Fairycycles and badge attached to every machine. Simply fill up the form when you buy your Fairycycle, post it to Lines and you will then become a member. This is the badge of the Fairycycle Association.

LINES BROS. LTD., MORDEN ROAD, MERTON, LONDON, S.W.19



HIGH FINANCE!

This is a true story of two small boys at a preparatory school. One of these budding business men had a watch that he offered for sale at the attractive price of three shillings. The other boy offered half-a-crown—representing the whole of his available capital; but the vendor declined to sell for less than the sum for which he had asked.

Matters, it seemed, had come to a deadlock. However, a way out of the difficulty was found. It was agreed that the watch had a perfectly good glass easily worth sixpence, and by smashing it the price of the bargain was brought within the means of the purchaser! *"Morning Post."*

* * * *

"My advice to you," declared the football manager, handing the would-be centre forward his release, "is to join a club in one of the 'Twenty Thousand Leagues Under the Sea.'"

* * * *

Shikari: "Sahib, I saw a lot of tiger tracks a mile to the north."

Hunter: "Good! Er– which way is the south?"

* * * *

Teacher: "Where was Magna Charta signed?"

Schoolboy: "At the bottom, sir."

* * * *

NON-STOP

The very new motorist drove right on past a sign which said "Stop."

"Can't you read?" the policeman called after him.

"Yes," replied the motorist, "but I can't stop."

* * * *

Bride: "I want a pound of mincemeat, and please take it from a nice young mince."

* * * *

Teacher: "Words ending in 'ous" mean 'full of,' as 'joyous,' 'full of joy,' and 'vigorous,' 'full of vigour.' Now give an example of such a word."

Tommy: "Pious."

* * * *

"What kind of a car have you got?"

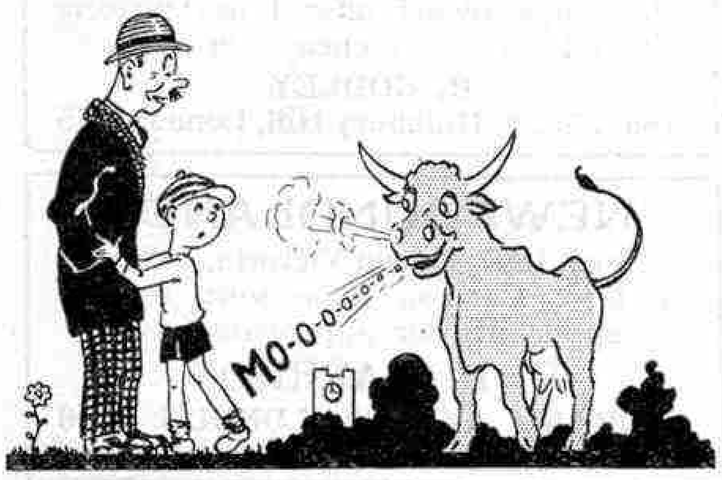
"A wreck."

"A wreck?"

"Yes, every time I park it, a dozen people ask me if I reported the accident."

* * * *

ANOTHER PROBLEM FOR FATHER



Small Boy: "Father, what are those things on the cow's head?"

Father: "Those are the cow's horns."

Cow: "Moo-o-o-o-o."

S.B.: "Father, which horn did the cow blow?"

* * * *

The barber was in better form than ever. Hardly once had his customer been able to speak, but his chance came when the barber said, "Your hair is getting thin, sir. You should put something on it."

"I do," replied the customer.

"Ah!" said the barber. "And what is it may I ask?"

"My hat," said the customer. "Good-Morning."

THE SMALLEST EVER

"Yes, sir, this is a good restaurant. If you order a good cup of coffee, you get the best cup of coffee in the world; if you order a fresh egg, you get the freshest egg in the world; if you —"

"I believe you: I ordered a small steak."

* * * *

Teacher: "Now, Johnny, tell me what kind of clothes pussy wears."

Johnny: "Clothes?"

Teacher: "Yes, clothes. Does she wear wool? Does she wear feathers?"

Johnny: "You poor lady! Ain't you never seen a cat?"

* * * *

NOT HIS FAULT



Two labourers were wheeling soil in wheelbarrows. The foreman spoke to one of them, and said: "Look here, my man! Your mate's wheeling two barrow-loads to your one!"

"Well," replied the workman, "don't blame me, I've told him about it half a dozen times already."

* * * *

Father (reading school report): "'Conduct, bad; reading, bad; composition, arithmetic, history, bad—bad—bad!' What is the meaning of this, Gerald?"

Gerald: "I can't understand it, Dad. Do you think it might be a forgery?" *"Punch"*

* * * *

Magistrate: "How comes it that you dared to break into this gentleman's house at dead of night?"

Defendant: "Lumme, guv'nor. The other day you told me off for stealin' in broad daylight. Ain't a chap to be allowed to work at all?"

* * * *

A SPELL OF SICKNESS

"It was simply awful. I never had such a tough time in all my life. First I got angina pectoris, followed by arterio-sclerosis. I was just through these when I got tuberculosis, pneumonia and phthisis. Then they gave me hypodermics. Appendicitis was followed by tonsilotomy. I really don't know how I pulled through. It was the hardest spelling test I've ever had."

* * * *

Professor: "What is an oyster?"

Student: "An oyster is a fish built like a nut.

* * * *

A man was digging a hole in the road when two strangers came along and watched him.

"What are you digging for, my good man?" asked one.

"Money."

"And when do you expect to find it?"

"Sat'd'y."

* * * *

Employer (to typist): "Miss Smith, I am sorry I shall have to discharge you owing to your bad grammar and spelling."

Typist: "I do my best, sir."

Employer: "That may be, but it is quite evident you don't know the King's English."

Typist (after a pause): "Is he?"

HOW IT WAS DONE

A man asked an old negro servant to get him a good turkey. "Mind you, Sam," he said, "I don't want a wild turkey."

"I'll get you a tame one, boss," said Sam.

The turkey arrived. When the father of the family began to carve it his knife struck something hard and this proved to be shot. He sent for Sam. "I told you not to bring me a wild turkey," he said.

"Dat was tame turkey, boss."

"But I found the shot in him."

"Don't you worry, boss. Dat shot was intended for dis niggah."

* * * *

"Does your dog chase cows?"

"No, he's a bulldog."

* * * *

Teacher: "What is a synonym?"

Pupil: "It's a word that you can use when you don't know how to spell the one you thought of first."

* * * *

"I don't care if you do employ a thousand men, you can't hold a candle to what I make."

"No? What is it?"

"Gunpowder."

* * * *

OPEN FOR BUSINESS

"Johnny," said his mother, "for every fly you kill I'll give you a penny."

Johnny killed all the flies in the room and then opened the door.

"What is that for?" asked his mother.

"To let some more flies in," replied Johnny.

* * * *

"That is a skyscraper," announced the guide.

Old Lady: "Oh, my! I'd love to see it work."

* * * *

The editor wheeled his chair around and pressed a button on his desk. The office boy entered.

"Here," said the editor, "are several directions from outsiders telling us how to run our paper. See that every one is carried out."

And the office boy, gathering them all in a large waste-paper-basket, did so.

* * * *

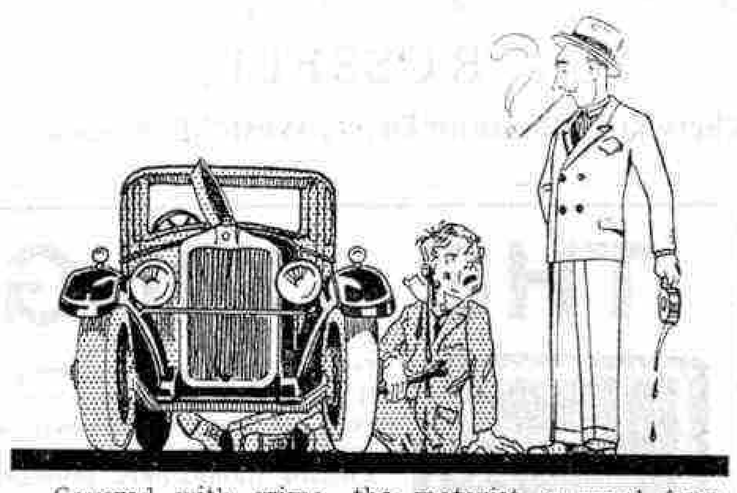
Small Boy (to visitor): "Have you got a wife?"

Visitor: "No, sonny, I haven't."

Small Boy: "Then who tells you what to do?"

* * * *

OVER-LUBRICATED!



Covered with grime, the motorist emerged from beneath the car. His smiling friend, fresh and debonair, beamed down upon him, waving an oil can.

"I've just given the cylinder a thorough oiling, old man," he said, "Thought that might help to make the old bus go."

"Cylinder be hanged," yelled the enraged one. "That was my ear."

* * * *

Visitor: "Isn't it difficult to keep your household budget straight?"

Mrs. Newlywed: "My dear, it's terrible. This month I've had to put in four mistakes to make mine balance correctly."

SG

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This Superb packet contains 475 Used Stamps including scarce Jamaica 1/– Queen Victoria, Siam, India. 73 Years' old New South Wales (view of Sydney), Canada. 59 Years' old Gold Coast, Nigeria, &c., &c.
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30	"	4d.	60	" ...	1/–
35	"	5d.	65	" ...	1/6
40	"	6d.	70	" ...	2/–
45	"	7d.	20	French Col. ...	2d.
50	"	8d.	30	" ...	4d.
55	"	10d.	40	" ...	7d.
60	"	1/–	50	" ...	10d.
65	"	1/6	60	" ...	1/2
20	Roumania ...	2d.	6	Nigeria ...	4d.
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Postage extra. *Approvals sent only by request.*
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150 STAMPS FREE

These are genuinely clean, selected Stamps and of value to any collector. This unparalleled offer I am making to advertise my cheap approvals.

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BRITISH COLONIALS ONLY.

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The Belgians are honouring England's great Explorer, H. M. STANLEY (to whom they owed so much for his work on the Congo) with a special issue of stamps bearing his head. I am therefore offering a packet of *African Stamps only*, representing most of the countries he explored and the adjoining States. ALL are GOOD CLASS Stamps. NO COMMON Continentals. GOLD COAST, NIGERIA, PORTUGUESE CONGO, a fine set of KENYA & UGANDA, MIDDLE CONGO, EQUATORIAL AFRICA, QUILEMANE (ZAMBESIA), IVORY COAST, RUANDA-URUNDI, RHODESIA, NIGER, ANGOLA and many others. Price 4½d., postage 1½d. extra. In addition to this I am presenting all who ask to see my approval sheets a SPLENDID set of 10 CONGO (including the Stanley Stamps) usually sold at 1/–. Senders of addresses of stamp collecting friends will receive a free set in addition. List of 700 sets and packets, 1d. extra.

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Stamp Gossip



Britain's Second Commemorative

For the second time in its postal history Britain has issued a commemorative stamp. The first occasion, or, strictly one should say, occasions, were the British Empire Exhibitions at Wembley in 1924 and 1925, and now, in connection with the 9th Congress of the Universal Postal Union being held for the first time in Britain, the second commemorative appears. The new issue has five values, ½d., 1d., 1½d., 2½d. and £1, which for the time being take the place of the current stamp issues.

The stamps made their appearance on 10th May, too late for us to prepare illustrations for this issue, but they will appear next month. The portrait of the King's head in profile has been retained as the central feature in each of the stamps, the head being superimposed on a Union Jack background in the 1d. and 1½d. values. Wreathed around is the wording "Postal Union Congress, London 1929," and the whole of the central design is enclosed in a chain link frame, surmounted by the customary crown and the wording "Postage and Revenue" in very small type. The value appears in numerals on either side of the crown, and at the foot of the stamp in words.

The ½d. stamp shows the King's head on a medallion on a white ground, surmounted by the crown and the word "Postage." On each side of the medallion the value appears in figures and the commemorative inscription is at the foot



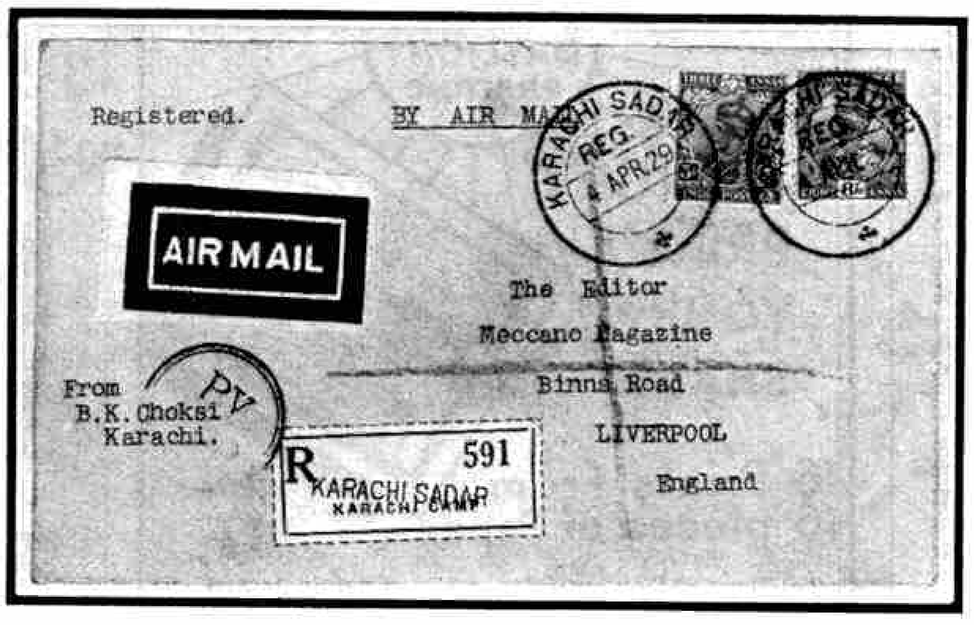
of the stamp. The 2½d. value is also a medallion design on a white ground, but in this case the medallion is surrounded by a belt bearing the Postal Union inscription, and the value appears in simple figures in each of the bottom corners.

The present watermark and colour scheme is retained throughout the issue, namely, Multiple Royal Cipher for the watermark and the colouring, ½d. green, 1d. red, 1½d. brown, 2½d. blue, but in slightly different shades. The £1 stamp, which, remarkably enough, for Britain's conservative stamp policy, is being issued specially for the occasion, is coloured black and has a special Royal Cipher watermark.

The England-India Air Mail

In the Air News last month reference was made to the successful completion of the first England-India and India-England air mail flights. By the courtesy of Mr. B. K. Choksi, of Karachi, we are able to reproduce a "flown" cover from the first batch of air mail from India to England.

Although passenger transport is the principal aim of this new Imperial Airways service, it is certain that His Majesty's



mails will be a close second best. In comparison with the saving of time, the surcharge of 6d. per half-ounce for mail matter is very reasonable indeed.

It is of interest to run briefly over the line of the route, the first stage in which is from London to Basel, where the mails and passengers are transferred to a night mail train en route to Genoa, Italy. A transfer is made at Genoa to Short "*Calcutta*" flying boats which cross the Mediterranean to Alexandria, from which point the journey is continued to Karachi, flying over the old Cairo-Karachi route via Baghdad and Basra.

This new service, by the way, is the world's longest regularly operated air mail service, but it is proposed later to extend the route from Karachi through Singapore to Australia, and when the full length has been completed it will be possible to fly from London to Australia in less than a fortnight.

* * * *

A Philatelic Commemorative

To commemorate the holding of the International Philatelic Congress in Melbourne in October last, the Postmaster General's Department printed a limited issue of a special 3d. stamp bearing a kookaburra design. There was only one denomination, the colour being blue.

The stamp was printed on a demonstration stamp printing plant which was one of the exhibits at the Congress. The size and shape of the stamp is similar to that of the present 1½d. issue.

Canada's Greatest Bridge

Readers of our recent Bridge Stamp article will be particularly interested to see the design of Canada's new 12c. stamp, which shows a magnificent view of the famous Quebec Bridge, the greatest cantilever bridge in the world, dwarfing even the great bridge that spans the Firth of Forth. It is one of the best examples of stamp designing ever produced; in fact, as we suggested in the brief comment in our April issue, the complete series is a triumph in stamp production.

The story of the Quebec Bridge is the most dramatic in the history of bridge building. Twice, disasters occurred when the engineers were within an ace of completing their task, and over 80 lives were lost. This magnificent structure crosses the St. Lawrence at a point where the river is 2,000 ft. in width, 200 ft. in depth and flows between banks 200 ft. in height; and has a total length of 2,239 ft., comprising two approach spans 140 ft. and 269 ft. in length respectively, two anchor arms each 515 ft. in length, two cantilever arms each 580 ft. in length, and a central span of 640 ft.

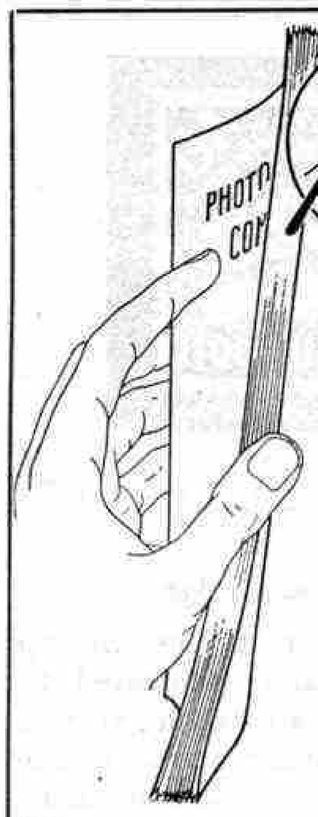
The first of the accidents occurred in 1907, after nearly seven years' work, when the whole of the south cantilever arm collapsed on its pier, some 8,000 tons of steelwork being hurled into the river with 86 men, of whom only 11 were rescued. The second occurred in 1916 when the central span was being hoisted into position. Almost without warning, when



the great span was about 30 ft. above high water level, it twisted over, collapsed and plunged into the river.

It certainly seemed at that time that the Quebec Bridge was an ill-starred venture, but the sponsors of the scheme were undaunted. The third attempt was successful and on 3rd December, 1917, the great bridge was completed and opened.

We also illustrate the 50c. stamp which is specially interesting because it bears an unusual design, a sailing race in progress. This design commemorates the victory of the Canadian fishing smack, "*Bluenose*," over its American rivals in the International Fishery Schooner race.



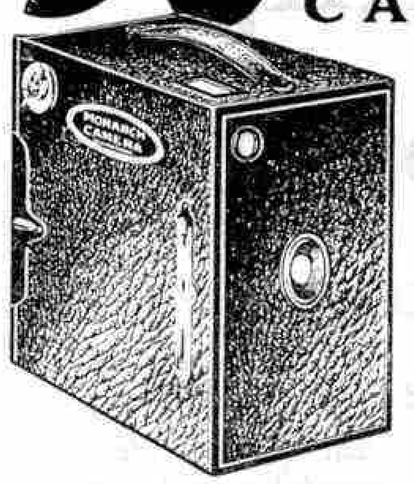
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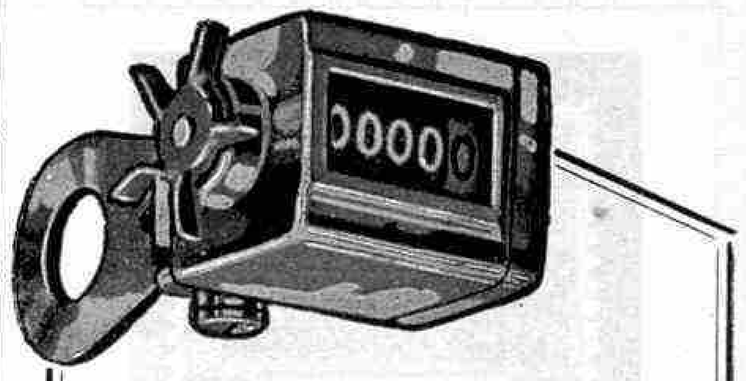
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Stamp Advertisements

(Continued from page 500)

Free. 100 Good Stamps, send for ½d. approvals, very best value.—Markwell, 31, Oakfield Rd., Newport, Mon.

FREE. 110 different Stamps to genuine approval applicants.—Gosling, 163, Felixstowe Road, Ipswich.

100 DIFFERENT STAMPS FREE. Send for ½d. approvals.—Cox, 135, Cambridge Road, Seven Kings.

30 CLEANED STAMPS FREE. Send for 1d. and ½d. approvals.—Miss Williamson, 18, Victoria Park, Dover.

200 Unpicked Stamps Free to approval applicants.—J. A. Warnock, Polton Road, Loanhead, Midlothian.

BRITISH COLONIALS. Ask to see my collection, 600 different on approval, all same price, ½d. each stamp.—Bickers, Lordswood Avenue, Southampton.

JAMAICA 1/- Queen Victoria's Statue is one of the **50 different** stamps, **all pictorials,** in the **Artistic Packet** from **Aitutaki, Ecuador, Jamaica, Malay,** Mozambique, **Niue, Penrhyn, Rarotonga,** Salvador, and **Samoa. Only these 10 countries. No etceteras.** Post free 1/4. **Mrs. N. Hall, "Newlands," Water-Orton, Nr. Birmingh'm**

DOMINICA
(West Indian Group). A new set of Pictorial Stamps from this British Possession sent free of charge to bona-fide applicants for selections of duplicates on approval.
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110, Barnett Road, Preston, Brighton, Sussex.

This Space is set to ⅛ inch s.c. and costs 8/- per month. The sum is the 50th of £20, the price of a whole page advertisement. Over 69,600 copies of the last issue were sold in various parts of the world. Your advertisement therefore reaches this exclusive public for approximately 1½d. per 1,000.

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A grand packet of **25 Different Stamps,** containing **Sardinia,** unused ; **Andorra,** the latest stamp-issuing country ; **Transvaal, 1896, 1d.,** unused, a fine stamp ; **Morocco Agencies,** K.G., unused ; **N. Borneo,** pictorial ; **Guadeloupe,** 1928, new issue ; **New Caledonia,** 1928, new issue ; **Kouang-Tcheou,** unused ; **Travancore,** unused ; **Cape of Good Hope ; Martinique,** creole ; **St. Pierre and Miquelon ; New Zealand,** Admiral ; **French Morocco,** pictorial ; **Dahomey,** pictorial, etc., etc., free to all asking to see my famous approval sheets and enclosing **2d. for postage and packing** (abroad 3d.).
S. HAMMOND, 2, CHESHAM FIELDS, BURY.
Albums from 1/- upwards. Collections purchased.



Blushing, Self-Consciousness

Genuine cure. No exercises. Send only 1½d. stamp.
M. F. HUGHES, 7, Southampton Row (B167) London.



Boys! Here's your bike

A bike to be proud of **for 2/6 down** and nothing more to pay for a month. Perfect, long-lasting and good looking. Write for Catalogue and details of **15 days' trial.**

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R.S.O. PLATES
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Half the cost of films

	6 for	12 for
3½ × 2½	9d.	1/3
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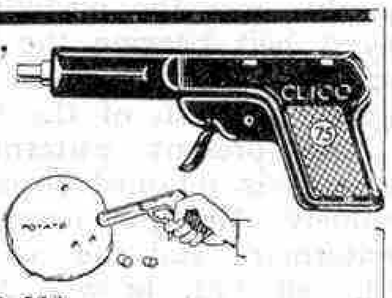
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BOYS MAKE YOUR OWN LEAD SOLDIERS

Cowboys, Indians, Animals, Zulus, Model Farmyard Sets, Rodeo, etc. Our CASTING MOULDS make thousands from any scrap lead WITHOUT PREVIOUS EXPERIENCE. Send stamp to-day for Illustrated Catalogue. Complete mould ready for work **2/6.—"TOYMOULDS," 67, Stafford Street, Birmingham.**
"Mention Meccano."



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1/- ONLY
1/- or direct
1/3 post free
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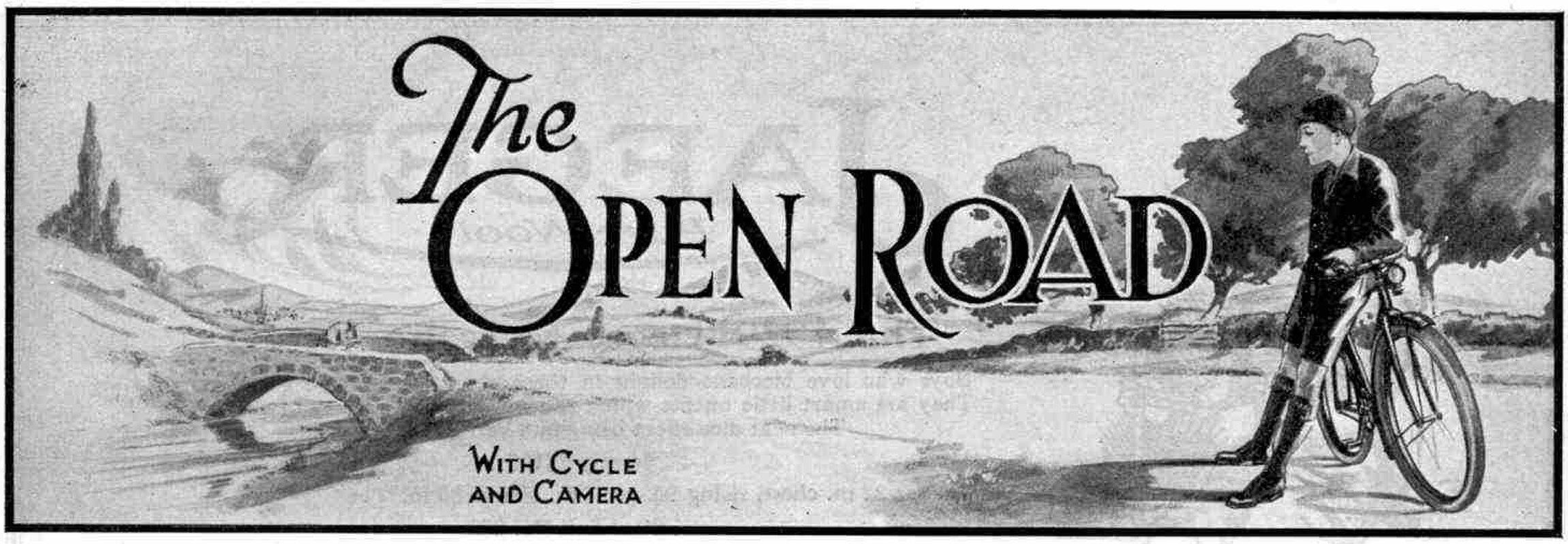
THE ABBEY POTATO PISTOL

The ingenious "Clico" moulds and fires, with a loud report, Potato, Apple, etc. This wonderful long range pistol is *ABSOLUTELY HARMLESS,* and provides hours of pleasure. No Caps to buy, no Peas to buy. A Potato Mother will supply.

Now turn to our adverts. on pages *511* and *512*.

Manufacturers of the Guaranteed Class T Clockwork Boat. Wholesale Agents for Isle of Wight Yachts, Rudds Helioflyers, Warneford Aeroplanes.

Abbey Sports Co. Ltd. (Dept. M.C.), 125, Borough High St., London, S.E. 1
Sole Concessionaires for the World.



Photography

THE EXPOSURE PROBLEM

Many young photographers appear to think that a faulty exposure can be put right in the process of development, but this is a great mistake. The developer brings out in visible form the effect that the light has had on the plate or film during the exposure. It cannot add anything that is not there; in other words it cannot remedy under-exposure. On the other hand it can only remedy over-exposure within very narrow limits. So we see that, unless an approximately correct exposure has been given in the first instance, our photograph is doomed to failure.

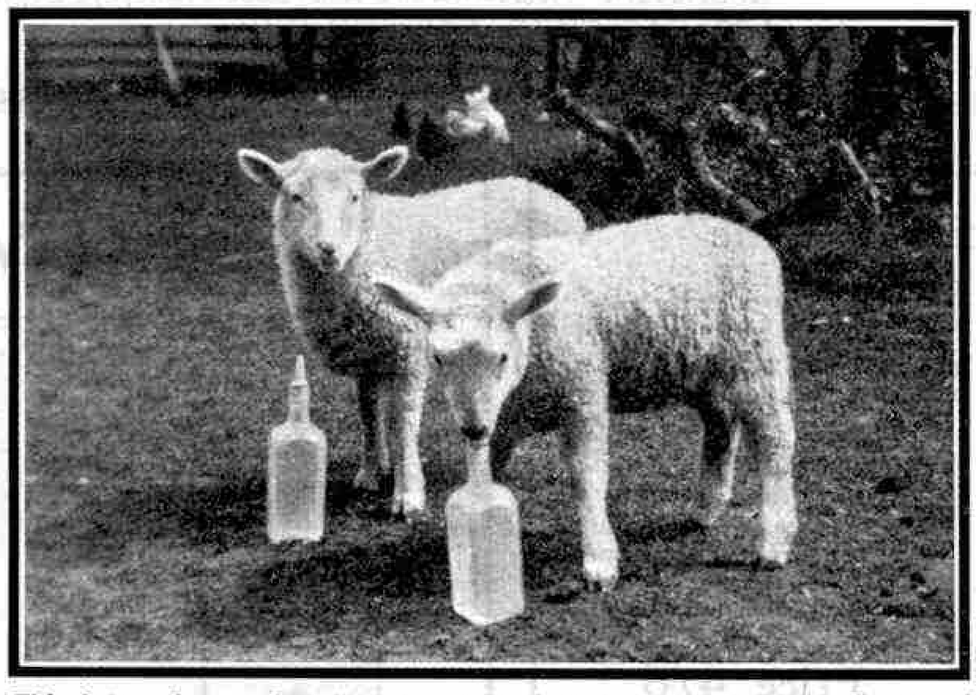
This brings us to what is very often called the "exposure problem," but actually there is very little problem about it. There are, of course, certain special branches of photography in which it is difficult to make certain of the correct exposure, but for the majority of subjects there is really no difficulty at all.

The exposure for any particular subject depends upon four factors—(1) the strength of the light, (2) the nature of the subject, (3) the aperture of the lens and (4) the speed of the film or plate. Of these four, the first is the most important to consider. As everyone knows, the strength of the light varies from hour to hour and day to day, and if we were obliged to estimate its photographic strength by the eye alone, we should find it a troublesome matter. Fortunately, such a measure is rendered quite easy by the use of an exposure meter or calculator.

An exposure meter usually consists of some kind of case containing a long strip of sensitized paper that darkens when exposed to light. To use the meter, a tiny piece of this paper is moved forward beneath an aperture, and is exposed to the light falling upon the subject to be photographed. Close beside the paper is a standard tint, and a note is made of the time that the paper takes to darken to this tint. This time, taken in conjunction with the speed of the film and the size of the lens aperture, gives the correct exposure. No calculation is required, the whole process being a matter of manipulating tables on the meter according to instructions.

Exposure calculators differ from meters in that there is no actual measuring of the strength of the light. Simple tables are provided for each month of the year, the time of day, and the general weather conditions. One of the most reliable calculators of this type is that incorporated in the handbook published by Messrs. Burroughs Wellcome & Co. This calculator is remarkably easy to use, and will save many times its cost in plates or films in the course of a season.

In using a calculator, judgment is really only required in regard to the subject.



This interesting study of lambs at feeding time, taken by H. Jones of Blackthorn, Oxon., gained first prize in Section A of our 39th Photographic Competition

This is a perfectly simple matter with the Wellcome calculator, for varying classes of subject are illustrated so clearly that it is almost impossible to go wrong.

Cycling

WHAT TO TAKE ON TOUR

The success or failure of a cycling tour depends very largely upon the bulk and suitability of one's equipment. The natural tendency is to take far more equipment than is necessary, and perhaps the best way to counteract this is to make a preliminary list of the articles that appear necessary and then to go over it carefully, item by item, striking out everything that can possibly be done without. If the tour is to last more than a couple of days a change of underclothing is necessary, and it is often possible to avoid carrying this parcel by posting it on in advance to some place that will be visited on the tour. Having effected the change, the discarded garments may then be parcelled up and posted home.

If a camping-out tour is planned, a waterproof sleeping tent is the first necessity. If this is being bought new it is very important to see that it is really portable, for many tents, while thoroughly satisfactory when erected, cannot be reduced to convenient proportions for carrying on a cycle. In addition to such personal necessaries as hair brushes, tooth brush, soap and towel, etc., it is a wise plan to carry a small first-aid outfit so that cuts or bruises can be attended to promptly. The camera, of course, will be one of the first items to have consideration, and one should make sure before starting that it is in perfect working order.

If a definite programme has been mapped out, the problem of sleeping accommodation is readily solved by making arrangements for each stopping place before the tour begins. If pre-arrangement has not been possible, a polite request to a farmer, for permission to camp on his land for the night, will rarely be refused.

Eggs, butter and milk can also be secured at the farm house and hot water can be obtained from the same source when a camp fire is not lighted. This must never be lit where danger can possibly arise from a flying spark and one member of the party must always be in attendance whenever the fire is burning. When leaving the camping ground, burn or bury every scrap of refuse, see that the fire is definitely out and close the gates behind you.

Even more important than personal equipment is the machine itself. Obviously one cannot have an enjoyable cycling tour without a thoroughly efficient and reliable machine, and a complete overhaul should be given before setting out on the road. Particular attention should be paid to the bearings and the chain, which should be cleaned and oiled. Another important point that requires attention is the adjustment of the brakes, and finally the lamp should be cleaned of old oil and charred wick and carefully filled and trimmed. A complete tool kit, a pump and a repair outfit are essential, but one set will serve the whole party.

Tyre trouble is fatal to the enjoyment of the tour; substitute new tyres for any that are badly worn.



The 1929 Jaeger Meccano Jersey

JAEGER
Pure Wool

The 1929 Jaeger Meccano Jerseys

Boys who love Meccano delight in these charming knitted garments. They are smart little outfits which can be had in a variety of colours. The neat dice effect being in a variety of colours.

Jersey BJ105

7/- for 22 in. chest, rising 9d. per 2 in. size to 30 in.

Knitted Suit No. 852

13/- for 20 in. chest, rising 1/- per 2 in. size to 26 in.

¾ Hose, Turnover Tops to match from 2/9 for size 3 to 3/9 for size 10.

Colours :

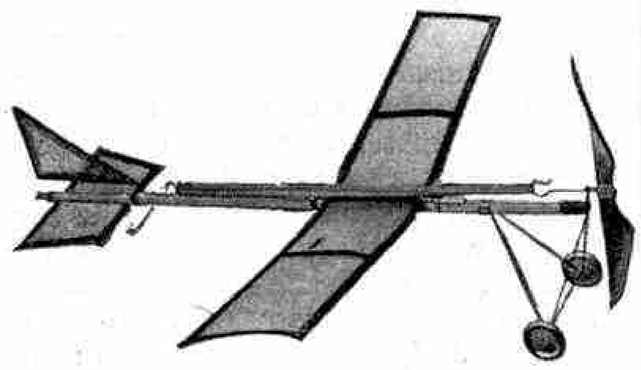
Navy with Royal Blue and Saxe border.
Drab with Brown and Saxe border.
Mixed Grey with Red and Saxe border.
Fawn with Navy and Saxe border.
Mixed Brown with Brown and Orange border.
Saxe with Navy and Light Saxe border.

Obtainable only from Jaeger Branches and Agents.
(*Write for the address of your Local Agent*).

HEAD RETAIL BRANCH : 352/54, OXFORD ST., LONDON, W.1.
WHOLESALE & SHIPPING : 95, MILTON ST., LONDON, E.C.2.

AUSTRALIA—Melbourne, 234/236, Flinders Lane, Sydney, 38/44, York Street.
CANADA—Montreal, 1187 Bleury Street.

For Design and Efficiency—The
Famous "SKISAIL" Tractor
Monoplane Stands SUPREME



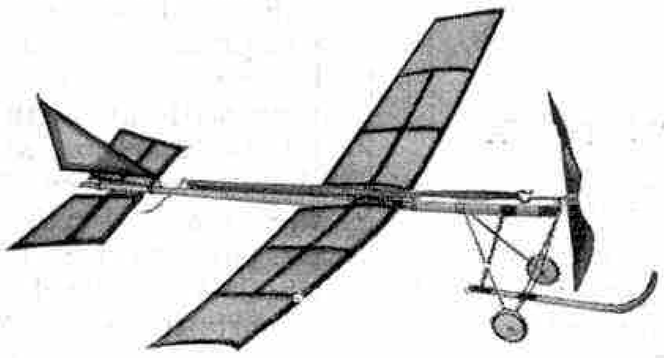
Our Famous No. 5
as illustrated.
Note Size—Wing Span 21 in. Length 20 in. Flight 100-150 yds. Despatched in strong box with full instructions

Price 4/6
Postage 6d.
Best Value on the Market.

GUARANTEE.—These models show perfect stability in flight, will rise from the ground and fly from 150 to 450 yards according to size, in straight or circular flight.

SPECIFICATION. Silver Spruce Fuselage, Silk-covered Planes, Aluminium Wheels, Polished Propeller. Nos. 0, 1, 2, and 3 fitted with our **Famous Patent Safety Chassis with Bamboo Runners.**

Our No. 2 Model
as illustrated.
An attractively designed and a most realistic flier. Wing span 29 in. Length 28 in. Fitted with **Our Famous Patent Safety Chassis with Bamboo Runner.**



Price 10/6
Postage 6d.

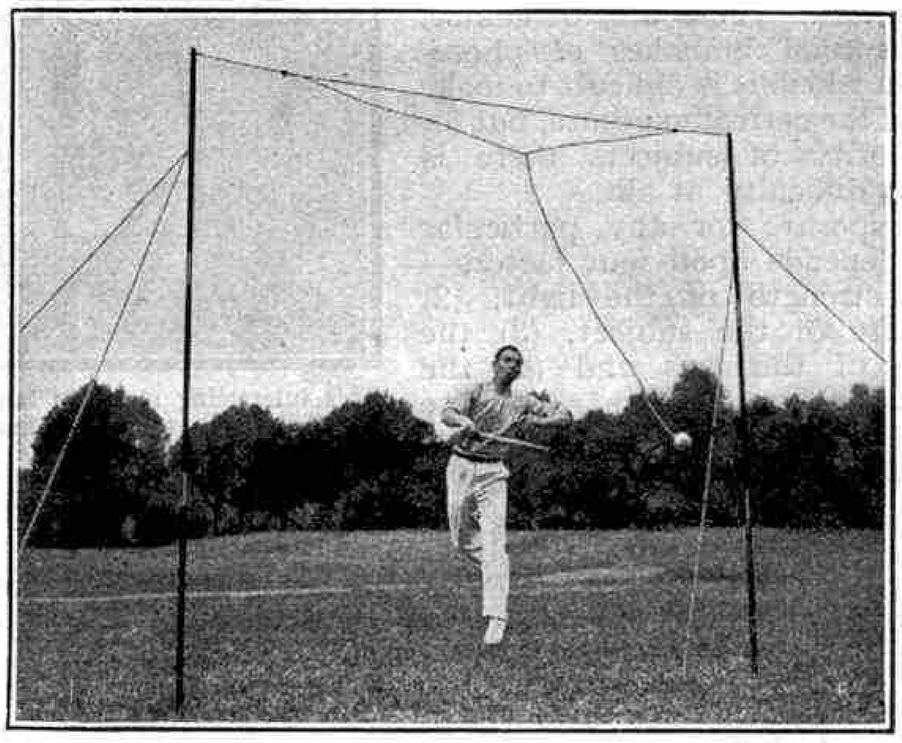
MODEL DE LUXE 27/6

Prices { No. 0 Price **18/6** No. 2 Price **10/6** No. 4 Price **6/6**
„ 1 „ **14/6** „ 3 „ **8/6** „ 5 „ **4/6**

The **"Skisail" Monoplanes** are designed on correct aeronautical lines, constructed with highest quality materials and are fitted with our **Patent Safety Chassis** and **Bamboo Runners,** a distinctive feature which makes them superior to any other type on the market.

Send P.O. to : **PATENT MODEL MANUFACTURERS**
159, Lymington Avenue, Wood Green, LONDON, N.22. *'Phone : Tottenham 3278*

"KUM-BAK"



The illustration is a

"KUM-BAK" TENNIS TRAINER

The ball is suspended on elastic held at each end by two upright poles. It is an ideal Tennis Trainer and makes an excellent game for one or two players and can be used in a very small garden. Complete set with spare strand of elastic - - - **21/-**
Elastic and Ball only, **4/-**. Post Free in Great Britain.

ORDER NOW FROM

W. HARRIS BRADLEY
MECCANO SPECIALISTS
Victoria St. and Skinner St., Wolverhampton
Send for 1929 Sports Catalogue Post Free.

How to Use Meccano Parts

(*Continued from page 469*)

The various devices dealt with in the Manual have been divided into thirteen different sections, under such headings as Gear Ratios, Belt and Rope Mechanism, Clutches, Reversing and Drive-changing Mechanisms, Brakes and Governing Appliances, Steering Gear, etc., and they are arranged so that immediate reference may be made to any particular motion that it is desired to incorporate in a model. Used in conjunction with the ordinary Instruction Manuals, the Standard Mechanisms Manual will form a very useful and instructive book.

Forging Fifty-Ton Crankshafts

(*Continued from page 463*)

which is held in a special carrier bracket mounted on the arm of the milling machine. The tool is adjusted to the correct finished depth in one of the splines and the machine table is then traversed by hand to plane out the surplus 0.002 in. of metal left by the milling cutter. By means of the indexing attachment, the other splines are similarly dealt with, and in this way they are left with a perfectly smooth finish in which no signs of the cutter traverse can be detected. It is interesting to mention that although, in this work, the splines are not touched by hand, the shaft can always be guaranteed to fit any hub and to give perfect contact over the whole of the surface. This is indeed a remarkable tribute to the great accuracy of the manufacturing processes.

Crankshafts are occasionally made of extraordinary, one might almost say weird, shape and proportion. Recently the writer saw one in which the crank pins are set at an angle of about 30 degrees to the line of the main bearings! Naturally the production of such a shaft with ease, accuracy and yet without undue cost, was only made possible by employing a special crank-pinning machine of the type already mentioned.

The crankshaft in question measures 17 ft. in length and has three 9¼ in. diameter bearings, its total weight being 2 tons 6 cwt. The shaft is of the single-throw counter-balanced type, machined from a chrome-nickel steel forging and "finish" machined all over. It is hollow throughout its length and is used to distribute oil to all parts of the engine. Counter-weights are bolted to extensions of the crank-cheeks.

September Model-building Contest Results—

(*Continued from page 471*)

up the track towards the winning post. If any competitor should attempt to increase the speed of his car by turning his Crank Handle at a greatly increased rate, the centrifugal governor mechanism comes into play and draws the "idler" Pinion out of engagement, thus disconnecting the gear train between the Crank Handle and winding drum and bringing the car to a standstill. From this brief description readers will understand what an exciting and ingenious game the model must be. To be successful in a contest of this kind a steady hand is essential. When nearing the finishing post, however, I can well understand how difficult it would be not to give the Crank Handle an extra quick turn, but to do this would, of course, spell disaster.

Binding the "M.M."

In response to many requests, we have arranged for binding cases for back numbers of the Magazine to be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases are supplied in two sizes (1) for six copies, price 3/6 and (2) for twelve copies, price 5/3 post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth



and the back and a quarter of the sides are dark crimson leather as shown above. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding Six or Twelve Copies

These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool, carriage paid.

Meccano Cycle Pennants

The arrival of summer with its sunny days will awaken the interest of our cycling readers in their favourite outdoor recreation. Machines will be overhauled in readiness for long days in the saddle, and while this annual process is in operation we suggest that a Meccano handlebar pennant be fitted.

The pennants are attractively prepared in the standard Meccano colours, red and green. They make a very attractive ornament to any machine, and in addition serve as an introduction to fellow Meccano enthusiasts when they are encountered on the road.

Messrs. R. Crook & Sons, The Arches, Kew Green, London, W., will be pleased to give full particulars to all enquirers.

Hospitals for Crippled Ships—

(*Continued from page 437*)

submerged in order to receive submarines into its chamber, where they were subjected to hydraulic tests. In addition it could be used as an ordinary floating dock and it could drydock two submarines at once.

After the Armistice this dock came into the hands of the British Admiralty and was towed to England. The Admiralty had no use for it, however, and ultimately it was purchased by Cox & Danks Ltd., who towed it to their Queenborough ship-breaking yard for demolition. While this work was in progress, Mr. E. F. Cox, the Managing Director of the firm, became increasingly impressed with the enormous lifting capacity of the dock, and the idea occurred to him that with the aid of the dock the scuttled German fleet at Scapa Flow could be salvaged.

Although salvage experts in general considered the idea impracticable, the firm made ready to carry it out. Four of the sunken German destroyers and the capital ships "*Hindenburg*" and "*Seydlitz*" were purchased from the Admiralty, and the adapting of the floating dock to the task of raising them was commenced. The cylinder was entirely demolished and one side wall and part of the under-structure were cut away. Along the 400 ft. length of the new face of the pontoon, 6 in. diameter steel shafting, fitted with specially-designed 42 in. diameter pulleys faced to take either cable chain or wire rope, was erected. The other wall was converted into workshops fitted with the necessary machinery and tools to provide for the full equipment of the dock. Twenty triple-geared hand winches, each having a capacity of 10 tons direct off the drum were erected, and 20 pairs of five and six sheave blocks with 20 in. sheaves, capable of a lift of nearly 150 tons each, were installed for working with the winches.

It was not considered advisable to carry out any further work at Queenborough and the next task was to get the dock to Scapa Flow. Great difficulty was experienced in getting the dock off the mud and afloat. For a whole fortnight, as tide after tide flowed, desperate efforts were made to move the dock, but the rate of progress was only inches at a time. Then dogged determination had its effect and, by the combined efforts of tugs, winches and men, the dock was re-floated. Three tugs took charge of her and the voyage of 700 miles up the North Sea was commenced. The dock was an awkward thing to tow, but fortunately the weather remained fine and after a voyage of eight days Scapa Flow was reached safely.

In order to carry out the projected lifting operations it was necessary to cut the dock into two pieces so as to turn it into two pontoons. This work was carried out by means of the oxy-acetylene flame. One half of the dock was then swung round so that shafting and pulleys faced one another, each pontoon having its own set of 10 winches and 10 pairs of lifting blocks.

The pontoons were moored over the vessel to be raised and flexible steel wire rods were then passed over the pulleys of one pontoon, beneath the hull of the sunken vessel, and then over the corresponding pulleys on the other pontoon. Hauling was commenced at low tide and as the tide rose the vessel was slowly dragged to the surface. Tugs then towed the pontoons and their burden into shallow water where the vessel was beached.

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on the following three pages carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

BENNETT WATTS,
10, Silver Street,
Tel. 229 AYLESBURY.

BUTTERFIELDS & MASSIES Ltd.
Church Street,
Tel. 141 BARNSLEY.

J. BELL,
10, Lower Garfield St.,
Royal Avenue, BELFAST.

SPORTS DEPOT,
57, Victoria Street,
Tel. 4554 (Nr. Albert Memorial) BELFAST.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
Tel. 461 BLACKPOOL.

BURGESS' BAZAAR,
Opposite The Pier,
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REFLEX STUDIOS,
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RUSHWORTHS LIMITED,
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CHARLES E. READ,
64, High Street,
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S. H. ARTHUR,
15 & 16, Narrow Wine Street,
Tel. 511 BRISTOL.

GYLES BROS. LTD.,
Tel. 2888 24, Bridge Street, BRISTOL.
188, Whiteladies Road, Clifton, BRISTOL.
Tel. 143

JOHN HALL (TOOLS) LTD.,
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(off Grafton St.), DUBLIN.

DIXON'S
41, High Street,
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MARTINS',
232, Hilltown,
DUNDEE.

PHINS LIMITED,
45, Murraygate,
Tel. 3897 DUNDEE.

ALDERTON'S,
8, Bank Parade,
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BASSETT-LOWKE LTD.,
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EDINBURGH.

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Telegrams : Stores, Exeter EXETER.

LUMLEY'S,
Lumley House, Sauchiehall Street,
Tel. : Douglas 2701 GLASGOW.

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GLASGOW.

POLLOCK & CO., 36, Bridge Street,
222, Argyle Street
(Under Railway Bridge), GLASGOW.

ROWANS LIMITED,
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13, Cross Church Street,
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RUSHWORTHS LIMITED,
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YE OLDE TOY SHOPPE,
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35, Manchester Street,
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Reliance Cycle & Motor Co.,
29/31, Manchester St., Liverpool.
Argyle & Conway Sts., Birkenhead.

FREDERICK BECK,
22, 24 & 26, Camden Passage,
Tel. : Clerkenwell 8403 LONDON, N.1.

DAVIES & CO.,
157, Leytonstone Road,
Stratford, LONDON, E.

DEMPSEY & CO.,
69, South Side, CLAPHAM,
Tel. : Brixton 3022 LONDON, S.W.4.

W. HUMPHRYS & SON,
269/271/273 & 275, Rye Lane,
Estab. in 1840 PECKHAM, S.E.15.

LEDWITH BROS.,
42 & 44, Walworth Road,
Nr. ELEPHANT AND CASTLE LONDON, S.E.17.

PERCIVAL & CO.,
140, High Street,
Tel. Wstw. 0120 WALTHAMSTOW, E.17.

F. J. WAIN & SON,
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MECCANO AND HORNBY TRAIN SUPPLIES

The nine dealers whose names appear on this page and those on the preceding two pages, carry full stocks of Meccano Outfits, Accessory Outfits, Meccano parts and Hornby Trains.

F. C. E. CLEAVER,
West End Garage,
West Street, SITTINGBOURNE.

Osborn & Co. (Southampton) Ltd.,
9, High Street,
Tel. 3587 SOUTHAMPTON.

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Tel. 4998 SOUTHPORT.

H. Binns Son & Co. Ltd.,
Sunderland, also at Darlington, Middlesbrough, West Hartlepool & South Shields.

DAN MORGAN,
"The Meccano Centre,"
218, Oxford St., SWANSEA.

GOLDSMITH'S,
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E. M. COLLINS,
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L. MYERSCOUGH,
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MECCANO ENAMEL

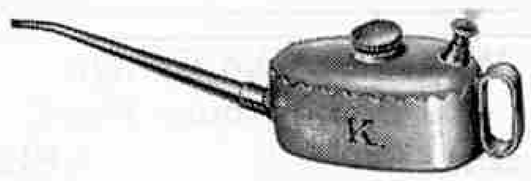


Meccano enamel has been introduced to enable model-builders to convert nickel parts to colour or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red, grey and green, each colour being identical in shade with the enamels used in the Meccano Factory for spraying Meccano parts.

Price per tin 8d.

Meccano Ltd., Binns Road, Old Swan, Liverpool

OIL CAN No. 2 ("K" Type)



Every Meccano and Hornby Train enthusiast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect.

One of the oil cans was recently sent to H.R.H. the Prince of Wales, and a gracious letter of acknowledgment was received expressing H.R.H.'s admiration of the beautiful lines and perfect finish of this model. Price 3/6.

Meccano Ltd., Binns Road, Old Swan, Liverpool

Adventures in Meccanoland

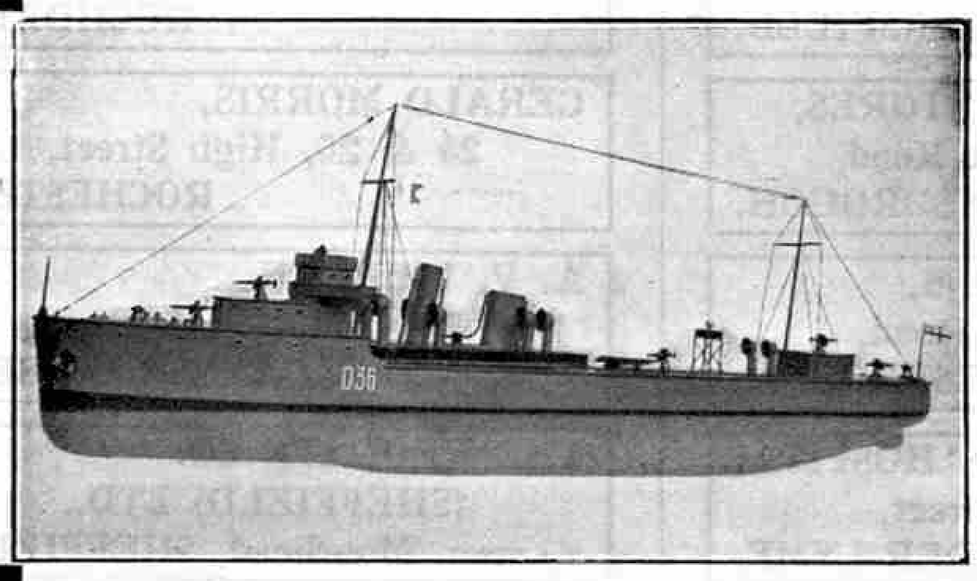


Every Meccano boy who has read the story of "Dick's Visit to Meccanoland" will be interested to know that we have now published a new edition of the booklet "Adventures in Meccanoland" telling of Dick's further adventures.

The booklet is profusely illustrated with humorous sketches, and Meccano boys will find great enjoyment in building up and operating the many different models that are the principal feature of the illustrations.

The price of the book is 2d. post free. All applications should be accompanied by stamps for this amount and addressed to Meccano Ltd., Binns Road, Old Swan, Liverpool.

British-Made Model Boats



Our new Ships' catalogue, now ready, contains some attractive new models for the Summer season.

SCALE MODEL DESTROYER. "No. D.36," as illustration above, fitted with efficient modern steam plant. Price **£10 10s. 0d.**

NEW MODEL LINER. Steam driven in either White Star, Cunard, Union Castle, or R.M.S.P. colours. Price **£13 13s. 0d.**

MODEL MOTOR BOAT "MERCURY," with clockwork mechanism. Price **£1 10s. 0d.** Electric pattern, motor working off pocket dry battery. Price **£1 15s. 0d.**

MODEL STEAM MOTOR BOAT "DIXIE." Price **15s. 6d.**

Don't buy a model boat until you have seen these new Bassett-Lowke masterpieces.

Other Sailing Yachts and Power Boats, Ships' Fittings and everything for the model ship-builder are described in our new catalogue section S/17 now ready, post free 6d.

Section A/17. MODEL RAILWAYS and ACCESSORIES, over 130 pp., post free **6d.**

Bassett-Lowke Ltd., Northampton

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112, High Holborn, W.C.1

MANCHESTER :
28, Corporation Street

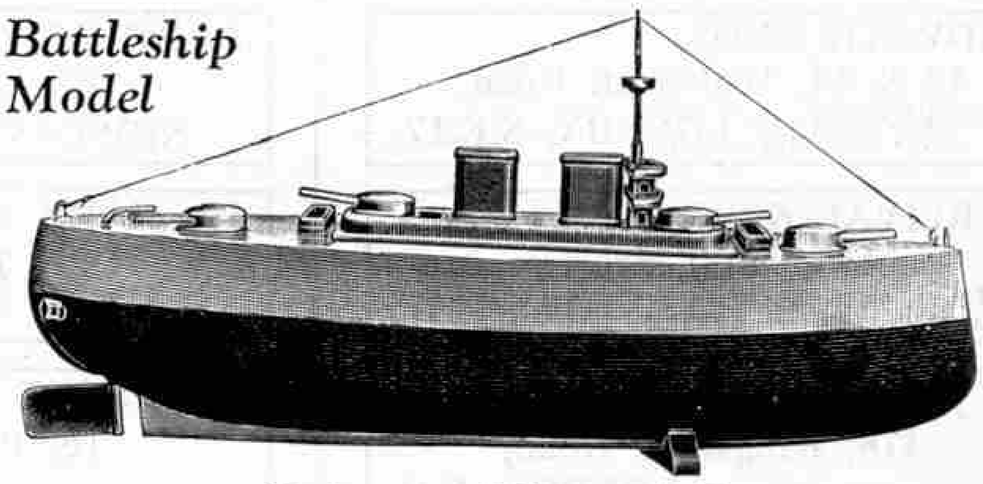
EDINBURGH : 5, Frederick Street

A New Sutcliffe Model

Have you seen the new Sutcliffe model motor boat? It is only 4/6 and is just as well made as the larger models.

Beautifully enamelled in two colours, the same wonderful driving power and all the other qualities which make Sutcliffe models far ahead of all others.

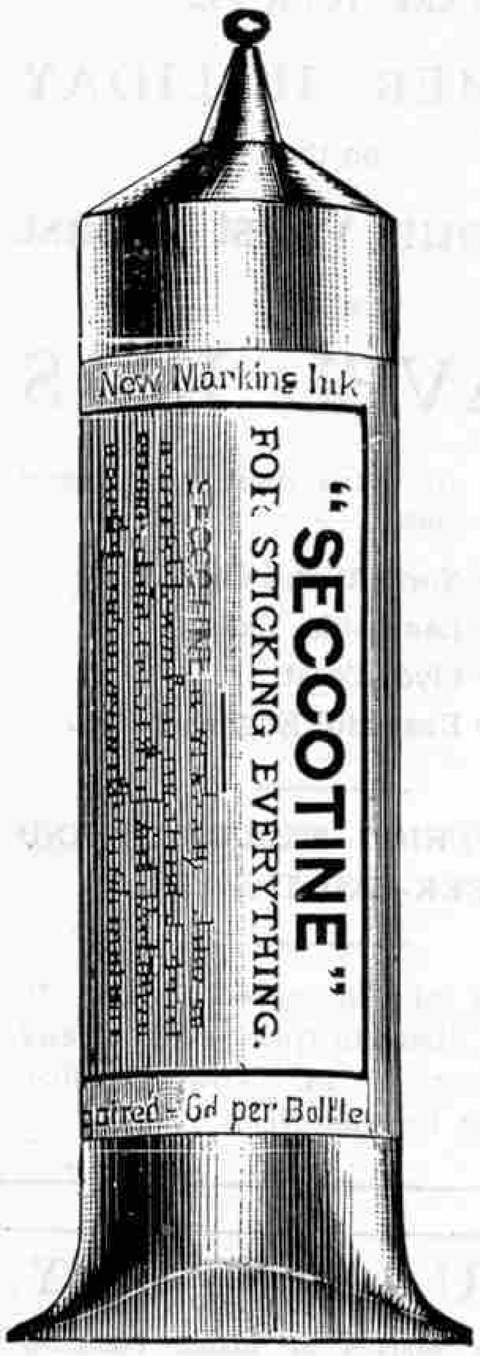
Battleship Model



Prices: 4'6 to 15'-

Hundreds of toy dealers have been provided with tanks to show Sutcliffe models actually working in the water—send a postcard for free catalogue and address of nearest agent.

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THE TUBE OF

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NOTE. There is nothing messy about Seccotine. Use the spike or pin supplied to open a new tube—at top of cone—press gently at end of tube (at folded part) for as much adhesive as is needed—then replace spike or pin which acts as stopper. Keep folding tube end as contents are withdrawn. Give mended article adequate time for drying.

TUBES are 4½d. (vest pocket box), 6d. and 9d. each. Sold everywhere.

Mothers should know that cups, saucers, tumblers, etc. intended to hold liquids, hot or cold—should be mended with FIRMAS (Heat Seccotine). Tubes 6d. each.

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The Linenhall Works BELFAST

"THE FLYING FOOL"



Something New in Aeroplanes

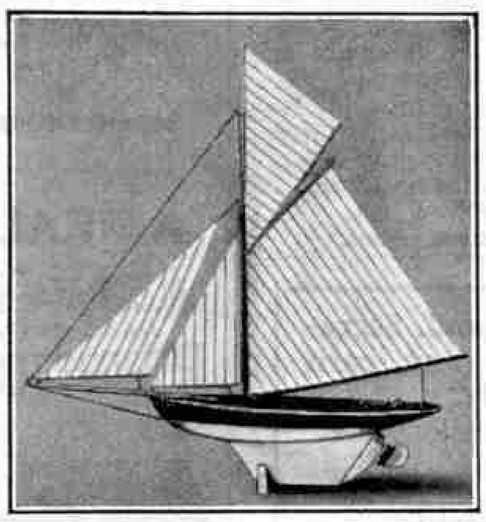
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27 in., 4-sail	59/6
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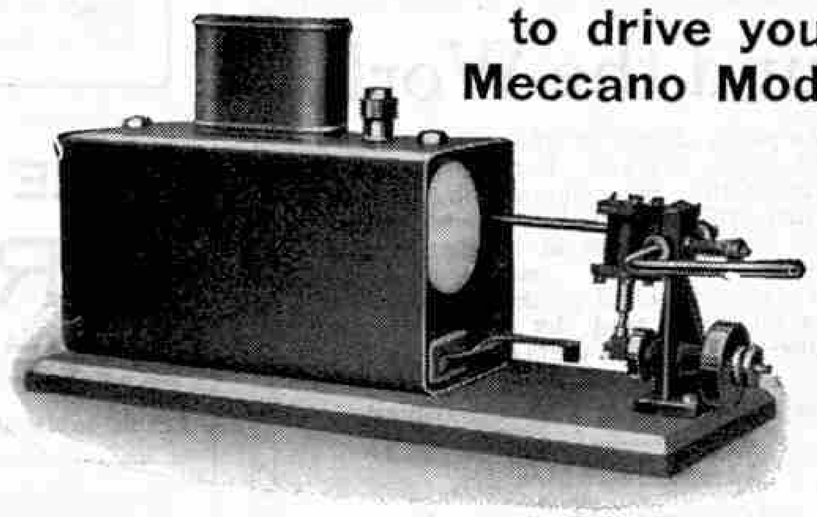
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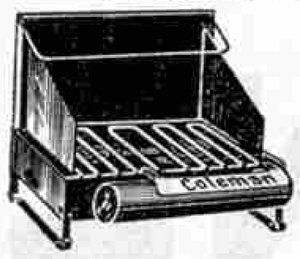
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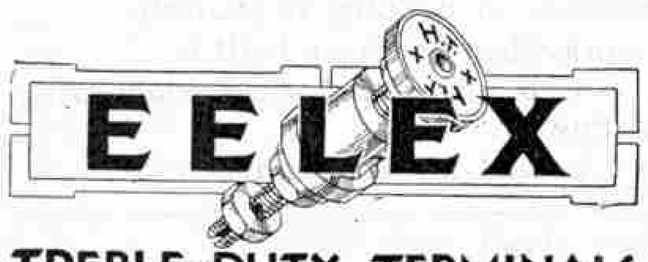
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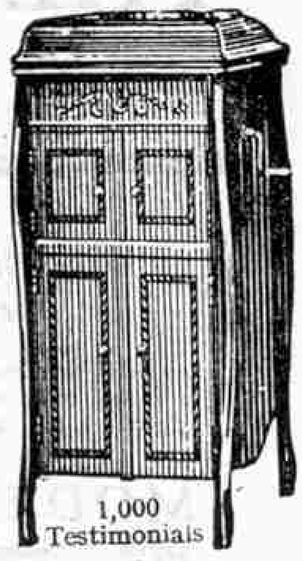
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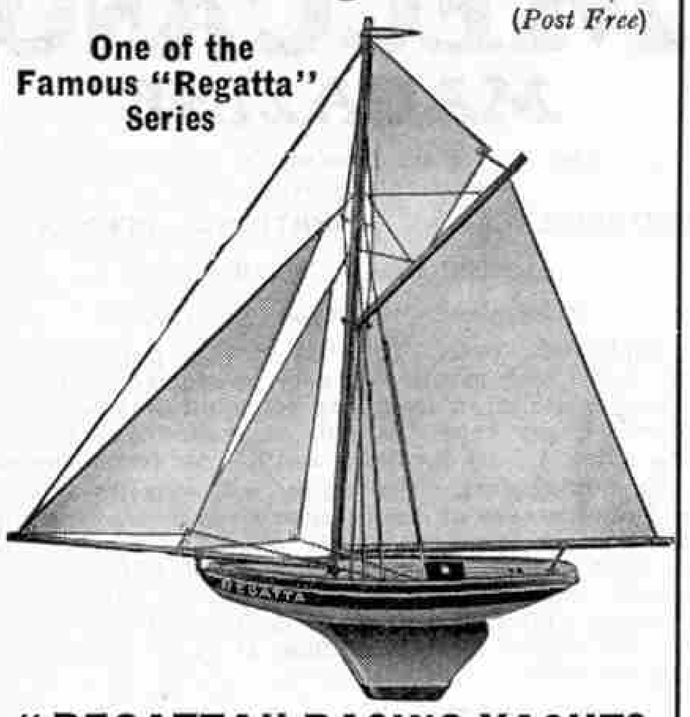
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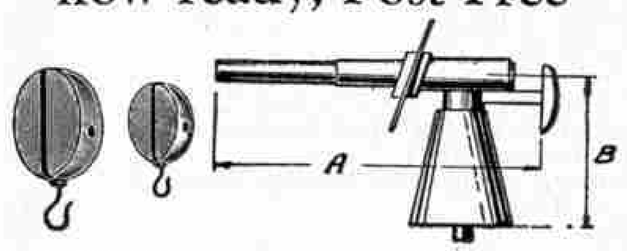
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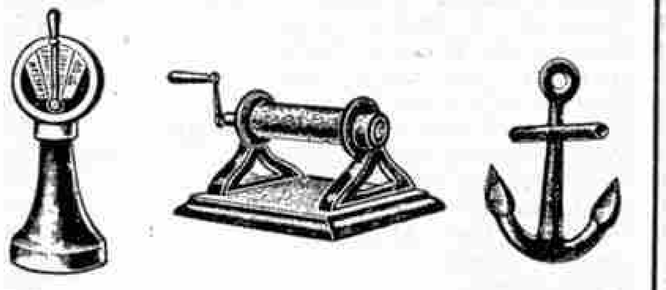
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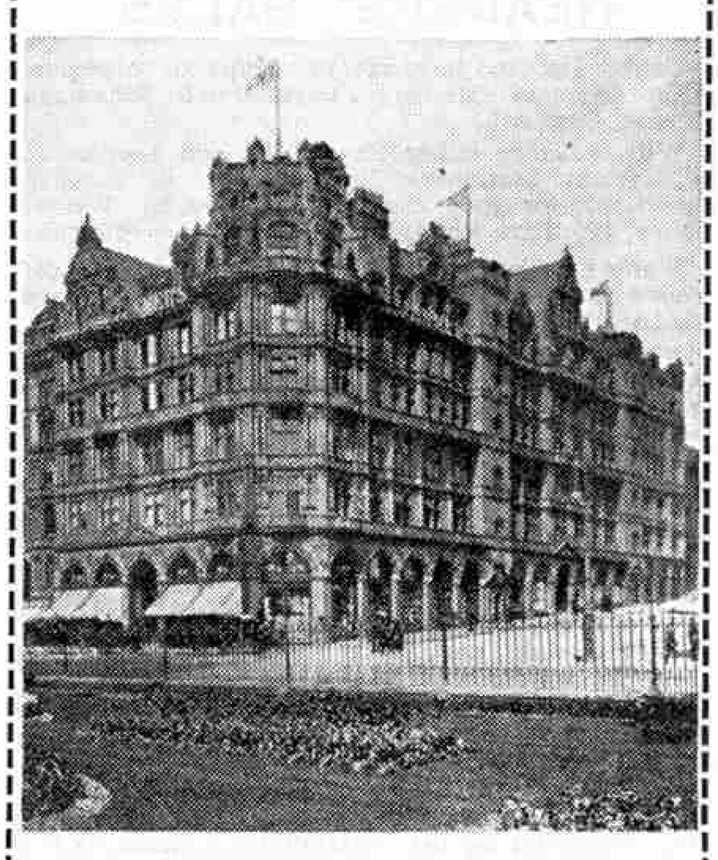
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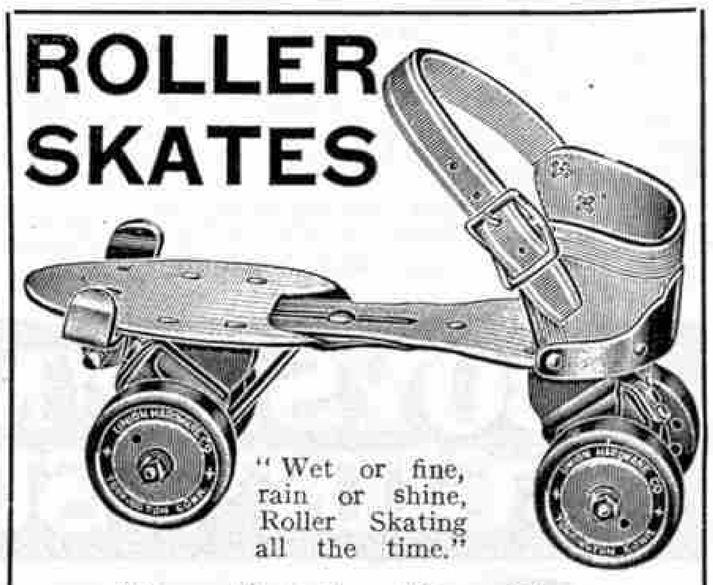


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Model Railway News, July 1927—May 1929, Country Station, Model Bookstall, 40 line-side Models, Signal Parts, Wagon. Cheap.—Boyd, Scorton, Yorkshire.

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Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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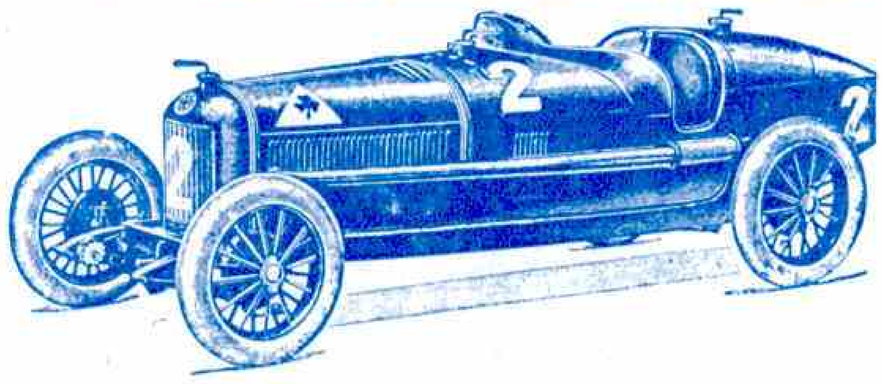
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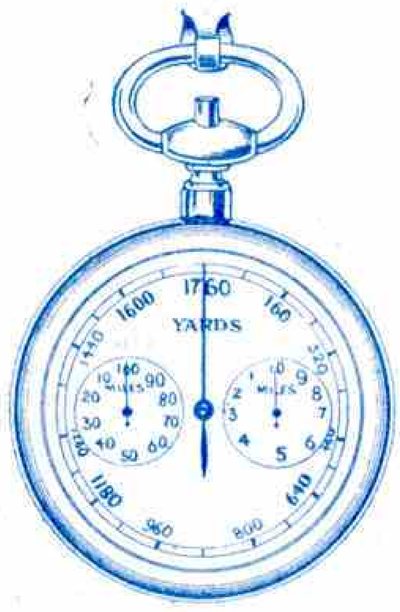
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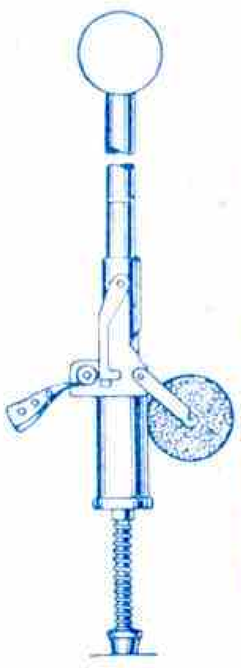
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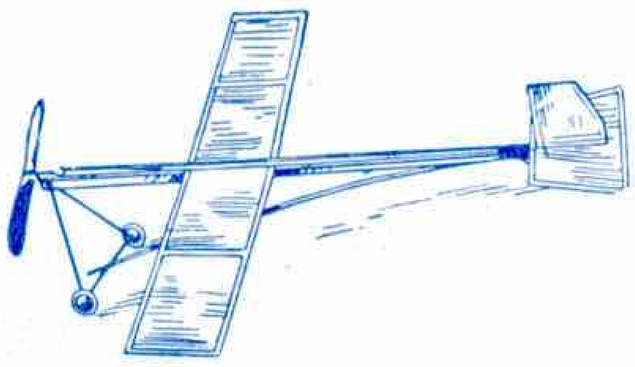
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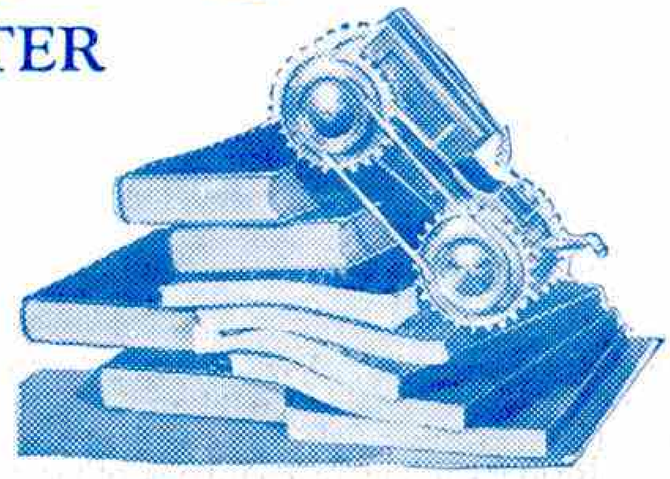


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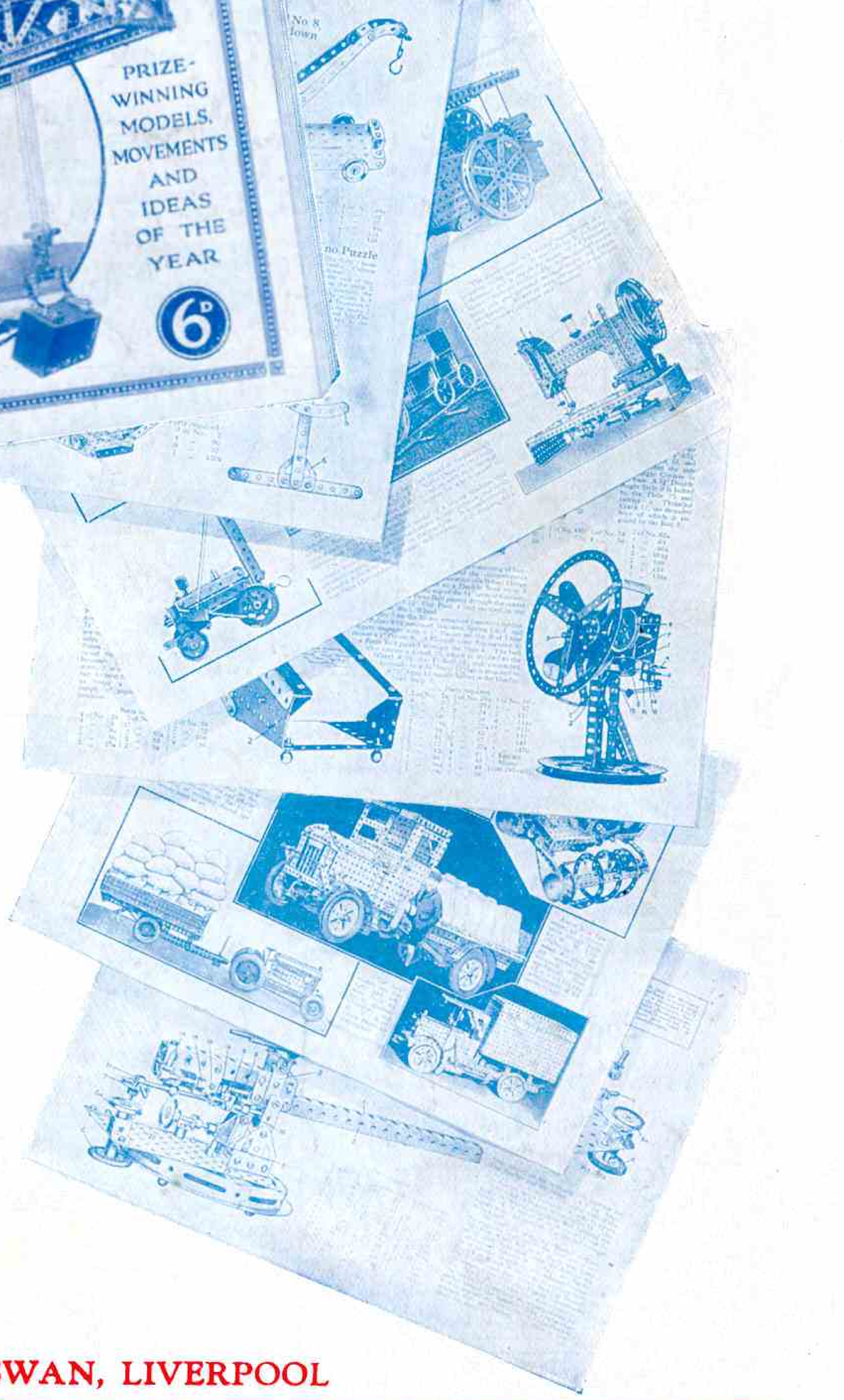
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PUBLISHED BY MECCANO LTD., OLD SWAN, LIVERPOOL
Printed by Stembridge & Co. Ltd., Albion Street, Leeds.